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Section of Agriculture and Applied Botany

BY THE EDITOR.

THE current year's session of the Indian Science Congress was held in Bombay from the 14th to the 18th January 1919. The Section of Agriculture was well attended; there were representatives from nearly every one of the provincial departments of Agriculture. The Bombay Department however had sent a very large number of its officers, a good number of whom also contributed papers. Occupying as it has been heretofore quite a prominent place among the different sections, Agriculture may be said to have claimed still greater attention in the present session. In fact next to Medicine, which was about the foremost in this session, Agriculture went strong. The place of honour among the addresses following that of the President of the Congress was given to an address on Nitrogenous Fertilisers by Mr. C. M. Hutchinson, B.A., which in the absence of the author was read by Mr. J. Mackenna, I.C.S., Agricultural Advisor to the Government of India, before a largely attended meeting. In the sectional meetings quite sixteen papers were read, including that of Mr. Keatinge, the senctional President, and

three days had to be sat through to finish the programme. There is no doubt that the Congress is helping to create the scientific atmosphere so much needed for the rapid development of research in this country and also to furnish an incentive to original work to many members of the various agricultural departments.

Nitrogenous Fertilisers.

Coming to the subject matter of the papers, we shall refer only to those of general interest, omitting those of local import of which also there were a few. In the address on Nitrogen manuring delivered before the general congress, the need for liberal manuring was looked at from a stand point somewhat recent in its signifance in this country, viz., increased production due to the cultivation of high yielding strains of crops raised by the plant breeder, multiplied on seed farms and supplied to farmers. This latter work is now very popular and as every one knows much is expected of it and all departments are laying themselves out liberally to push it on vigorously. But the increased production due to these better varieties would need greater manuring, for larger yields mean a greater depletion of soil fertility and without liberal manuring before long the improved strains will sink down to the level of the existing ones they were meant to displace—a result so little worthy of the time and money spent upon the raising and distribution of the improved strains.

This point was referred to by Dr, Coleman in his Presidential Address before the Agricultural Section at the Lucknow Congress 1918. One need hardly point out however that to develop and push on the work of raising better varieties can never mean diminished attention to the importance and need for liberal manuring which is insistent and fully recognised. When it came to the ways and means of supplying this need, one could not help detecting a note of despondency which was also reflected in the discussions that followed. Imported artificial manures are costly; of the cheaper manures there is not enough to go round, the manufacture of Calcium Nitrate and Cyanamide by the fixation of atmospheric Nitrogen is also likely to be too costly, and one has to fall back upon the practice of green manuring and the benefi-

cent recuperative work of natural agencies. Dr. Fowler of the Indian Institute of Science drew attention to the present waste of human excreta ; its utilisation as manure is a very important matter and though not always an agreable subject to speak about, has to be actively popularised by the departments. The need for concentrated fertilisers can never be got over but unless they can be made less costly they cannot be thought of. Relief can be looked for only in their manufacture in India itself, in the opening of other industries in which the fertilisers are bye-products in development of the fishing and fish curing industries, and the harnessing of more waterfalls for the generation of power whereby power can be got cheap. It is hoped that all these will gradually come with the industrial development which we are soon to see in this country.

The Consolidation of holdings.

Among the subjects at the sectional meetings the consolidation of holdings was well to the fore. During the past few years this subject has been under frequent discussion. Prof., Jevons, Dr. Mann, Mr. Keatinge, Mr. Burt, Dr. Coleman have all written valuable papers on the different aspects of the question. In his Presidential address on some Economic Factors affecting Agricultural progress, Mr. Keatinge, again returned to this subject. With his varied experience as a Revenue Officer and then as Director of Agriculture of a province where the Agricultural Department has achieved notable success in many directions, he spoke with great emphasis. " For agriculrural progress the farm should be a fixed and permanent unit, so that it may admit of permanent and adequate development and the farmer should be a fluid and moveable unit so that the right men may get to the right places. In India the exact reverse is generally the case ; the farm on the one hand is subject to a continuous series of economic earthquakes, the farmer on the other is fixed and rooted. To develop and improve a 10 or 20 acre farm is an intelligible proposition to any one ; but to develop a 10 or 20 acre farm which must in the near future be split up and fragmented is not an intelligible proposition to any one ; and since this is the proposition which confronts the Indian farmer, it is not surprising that he does not consider it

seriously. As regards the farmer, to whatever size the farm may deminish by division, he himself persists, whether he be good, bad or indifferent. In highly individualistic and competative countries efficiency is secured by the elimination of the unfit, who are squeezed out of the race, whereas in easy going India, the fit and unfit both remain on the land, the less effective members to the obstruction of the more effective members of the community."

Mr. Keatinge, of course, would have recourse to legislation to remedy this state of affairs, his point being that if your ideal is material progress, then you must legislate regardless of the objections that the people do not ask for it, that it would be opposed to their religious and other sentiments and that a shuffle of farmer and of farms would constitute a political danger.

The evils of unlimited fragmentation of holdings are fully known and admitted, but is the remedy suggested so very easy of accomplishment ? Does the enormous pressure on the land in this country continue because it is their religion and sentiment that ties them to their land, or is it because that there is not a variety of remunerative occupations that can absorb a surplus agrarian population ? If such an outlet is provided for this population, is it not reasonable to expect that the pressure will be automatically relieved ? Even supposing that the size of farms should be fixed by law and their sub-division also likewise forbidden, in the absence of other occupations what will be the result ? The surplus population still remains on the land though not as possessors of the farms, the village labour market is glutted, wages drop and we still remain where we are with our low standared of living. Furthermore when the landlord finds conditions so easy, where is the incentive for him to effect improvements on his farm ? Unless the country develops industrially, providing a diversity of occupations to the large population, we are afraid no measures will have the result we desire so much. We are strongly reminded in this connection of the remarks of the late Prof. F. H. King of Wisconsin who during his tour in the East was struck by the high degree of perfection of the Chinese and Japanese agriculturnl methods as compared with those of the American or

European farmer. Yet the latter leads a spacious life, with comfortable homes, automobiles and telephones, schools, churches, pleasure resorts, paved roads and streets and the many comforts of modern civilized life, and the Chinaman is the humble centuries-old oriental in that low scale of material civilisation that the term 'oriental' has come to connote. Prof. King rightly says this apparent paradox is due to the enormous pressure on the land. In Japan the restripping of the land or consolidation of holdings has been preceded, may be not intentionally, by nearly half a century of steady industrial development, in which their phenomenal success is only paralleled by their whole hearted and stupendous efforts. We venture to think that only with such development can any legislative or other measures we may adopt have any permanent success.

In a companion paper Mr. Burt gave examples of a few cases where such consolidation was effected in the U. P. and where the advantages are being appreciated by the landlords on whose farms the rearrangement was effected. In the discussion regarding the nature of the measures to be adopted, there was a consensus of opinion that to begin with efforts had better be made in educating the farmer by taking up areas in different centres, and then working a scheme of rearrangement of holdings in order to demonstrate the advantages. Legislative measures may be reserved to a subsequent stage when perhaps the rural population may be prepared to receive them kindly. Our readers may remember that this is about the view taken in our State where the Agricultural Committee of the Economic Conference in dealing with the subject, has requested district committees to suggest suitable localities where the scheme may be given a trial.

Soil aeration.

Dr. Howard's paper on the importance of soil aeration contained the results of further work. Poor development of the root system and a corresponding dimunition of the above-ground parts of the plant, denitrification in the soil inhibiting growth were all traced to lack of aeration. The wilt of indigo was also shown to be favoured by the same cause, from results obtained by growing plants in lysimeters in which those on the well

drained and properly aerated soil developed no wilt, while those on the water logged soil developed wilt.

Sugarcane.

Mr. Viswanath of the Coimbatore Agricultural College described his method of taking samples of cane juice for testing the ripeness of cane at different stages, by the use of a sort of hypodermic needle and the results of estimating sugar in the juice by the use of the Refractometer.

A companion paper from the same station was read by Mr. Krishnamoorti, who showed how the quantity of chlorine in the juice of the sugar cane may be taken to be a measaure of the alkalies present and of the extent of the harmful effect of such salts.

Improvement in sugarcane planting methods.

Mr. Kulkarni, Deputy Director of Agriculture, Dharwar, further described the results of planting sugarcane by his method of 'one bud one cane'. This consists in planting one set containing one eye bud, planted with the eye bud facing upwards, and when the crop comes up, leaving only the main cane from the bud to develop by cutiing out all additional shoots as they come up. A dose of Ammonium Sulphate is said to be needed for the young cane in the initial stages. Specimens of cane so grown were exhibited as well as photographs of the crop. The growth was very striking and the method deserves trial in other places as well.

Mr. Kulkarni also believes that the inequality in stand in ordinary farm crops is due to the various positions in which the seeds fall in the ground when sowing. Seeds planted in the right way give rise to plants which develop better than seeds sown wrong. These conclusions was borne out by a number of sand culture experiments, of which excellent photographs were exhibited.

Dairy Problems.

Two papers related to the Dairying Industry, one by Mr. Smith, Assistant Director of Military Dairy Farms and the other by ourselves. Mr. Smith laid great stress on the need for the development of the dairy industry in India on right lines for

meeting the growing demand for dairy products, for the improvement of the cattle, and for the sake of the manure of which the land is in great need. One of his main points was that it should be quite possible to breed a dual purpose breed *i.e.*, a breed which will be good for both draught and milking. It should be easy in that case for practically every farmer to produce considerable milk at a profit and dairy farming will become an adjunct to ordinary farming. The question of green fodder for dairy cattle came in for much discussion as any expansion of the dairy industry cannot be thought of without making adequate provision for fodder.

The second paper drew attention to certain aspects of breeding crossbred cows for the milk supply of cities, using European or Australian sires with local cows. The milking quality in which alone improvement is sought, was regarded as a Mendelian 'dominant' and on this basis it was shown that unless pure bred sires were always used, there was room for much disappointment in the performance of the cows produced.

Soil Erosion.

The prevention of soil erosion in the coffee and rubber estates of South India was the subject of a paper by Mr. Anstead. In addition to terracing he advocated the encouragement of the growth of leguminous weeds in preference to clean cultivation. In the discussion which followed Dr. Mann differed from Mr. Anstead and would not favour weeds for the purpose. We may mention that one of our members who owns extensive tea estates in Upper India thinks very much of the growing of a green manure crop between the rows of tea. We refer to this in our notes.

Nitrification.

Mr. Joshi read a paper embodying painstaking research into questions of nitrification in Indian soils, covering ground which has been covered many times over in the Experiment Stations in Europe and America. We consider such repetition of European experiments under Indian conditions very important, for it is quite likely that the results on which much of what we teach and recommend depends and which are

nearly all based upon European experiments, may not be found to follow under the conditions of the Indian soils and climate, so different from those of Europe. The function of the organic matter of the soil came in for much discussion, its importance as an aid or hindrance to nitrification was considered by some to be less than its other functions which remain however unelucidated.

Ring Disease of Potatoes.

The ring disease of the potato was the subject of a paper by Dr. Mann and his assistants. The transmission of the disease through seed, irrigation water and the soil itself were referred to. Contrary to experience in Bangalore the soil was said to become incapable of infecting after a period as short as three months. Much research work notwithstanding, the disease still remains a common and fruitful source of loss. One of the large dealers of seed potatoes in Poona informed us that he could tell a diseased potato without cutting it open, that in his seedstore women had been trained to sort out diseased potatoes by merely looking at them and that in this way he is able to stock and sell disease free seed.. We were sorry we had no time to visit Poona and inspect the process; but we had to inform this friend that potatoes sent out by him to Bangalore as disease-free did develop disease in soil which had not carried potatoes far many years.

The session was a most interesting one on the whole, the papers were many and some of a high order and carefully prepared. Many of these were illustrated by very good lantern slides; tabular statements, and graphs, photographs and considerable letterpress were all projected on the screen. This method greatly enhanced the effectiveness of the papers and is becoming quite popular. The opportunity afforded to members of meeting each other on such an occasion and exchanging ideas was itself valuable.

The Experimental Farm at Hebbal, Bangalore*

BY

G. S. Kurupad, V. K. Badami & others.

THE farm is situated five miles from Bangalore on the Bangalore Chickkaballapur road, just by the side of the road and very near the village of Hebbal. The farm consists of about 60 acres of dry land and about 20 acres of wet land. The wet land is situated below the Hebbal tank which supplies water all the year round except in exceptional years.

The farm came into being in 1905, and it was then organised by the Agricultural Chemist to the Mysore Government. From this time, till the year 1912 when the Agricultural department was reorganised, the scope of the work on the farm was quite limited. With the reorganisation of the department, the activities of the farm increased, and there was a rearrangement of the experiments conducted on the farm.

The prinicipal crops on which experiments are being conducted are ragi, paddy, and sugar cane.

Ragi.

The practice one usually meets with is that ragi is rarely grown as a pure crop. It is usually grown along with rows of a mixture of pulses and jola and this is continued year after year without much change. Experiments were therefore taken in hand to find out the advantages, if any, to be obtained by sowing a pure crop of ragi and by introducing some sort of rotation.

A numbur of 1/20th acre plots were taken and sown alternately with only ragi and with ragi having one row of mixed pulses and jowar every 4 feet. These experiments have now gone on for four years and are being continued. The pure crop gives us a chance of cultivating the field soon after harvest of the ragi The mixture plot, on the other hand, does not allow of any cultivation till all the pulses have been harvested, by which time the land will have got hard and will have to

*This is the first of a series of articles, each of which will deal with one of the Experimental Farms of the Mysore Department of Agriculture.—ED.

remain uutouched till the next year's rains, which means a loss of moisture and nutriment through the growth of weeds and other ways.

For the rotation experiments, a series of plots, each 1/20th of an acre have been used. Ragi has been rotated with *avare* (Dolichos Lablab) and groundnut for the purposes of this experiment. Every third plot in this series is sown with ragi year after year and acts as a check indicating the change that occurs in the matter of fertility, as we proceed from plot to plot and thus enables us to compute the results we get, fairly accurately, by allowing for this change in the fertility of the plots. The two plots between two successive check plots are now sown one with ragi year after year, and the other with ragi after either groundnut or *avare*. We have this experiment repeated a number of times to minimise possible errors in experiment. These experiments are being continued.

Experiments have been in progress for the last four years to investigate the response of the ragi to some of the green manures as compared with its behaviour towards other common manures. For the purpose of this experiment, sanhemp (crotalaria juncea) and cowpea have been used as green manures and these have been compared with farm yard manure and *hongey oil* cake (Pongamia glabra). A series of 1/20th acre plots are taken. Every third plot is utilised as a check, and receives no manure. These check plots serve as before to give us an accurate idea of the varying nature of the land as we pass from plot to plot. The experimental plots between the check plots are then successively manured with the manures already named, *viz.*, san hemp green manure, avare green manure, farm yard manure and hongey oil cake. In the case of the plots receiving green manure, these plots are sown with the respective seeds soon after the early rains in March or April and are ploughed in June or July and the ragi sown sometime in the month of July. In the case of the other two plots receiving farm yard manure and cake these manures are applied at the rate of 10,000 lbs. and $\frac{1}{3}$ ton per acre respectively and ragi is sown after these have been thoroughly incorporated into the soil. This experiment is repeated a number of times. The green manures

seem to cause a decided increase both in the growth and the yield and the experiment is being continued.

It is observed that generally, no particular care is taken in the selection of ragi for sowing purposes. Here and there we do find that certain cultivators are in the habit of selecting good earheads on the field and preserving these for use as seed later on. There are certain advantages accruing from this practice, which will be detailed later on in the account of the work of the Botanical Section. This work requires a certain amount of skill, and even when selection has been made in this way, the grains of ragi are not all uniformly robust. Therefore different methods of selection of ragi for seed, which do not require any great skill which are quite within the reach of most cultivators, and which give us seed of fairly uniform robustness, are being tried on the farm. There are two ways in which seed may be selected. One is by immersing the seed in brine, and rejecting all those grains which float. The heavier grain is then washed in fresh water to rid the grain of all adhering salt which might interfere with its germination, dried and used for sowing either immediately after or the grain so treated can be stored and used for seed later on. The next method is passing the grain through a sieve of a definite mesh. All the grain that passes through is rejected. Thus we get only the bigger sized grains for use as seed and since we know that ragi seed is very resistant to fungoid and insect attacks, we are fairly certain of having well grown, robust grain for seed purposes. This year, the two methods have been combined *i.e.*, the seed was first sieved and then selected by the salt water method.

The effect of these methods of selecting seed was quite apparent in the difference in the germination and the germination being uniform and assured, this selecting of seed grain minimises to a considerable extent the amount of grain that has to be sown to obtain a good stand of crop.

The common practice in these parts is to sow ragi in rows 5″ apart. Experiments are in progress to ascertain if a greater amount of space may not with advantage be allowed between the rows and also to find out the effect of interculture on the

crop. For this purpose ragi has been sown in rows 5" and 12" apart and the yield compared. The results so far obtained indicate the superiority of the wider spacing. Again ragi is sown in rows 12" apart, alternate strips are cultivated with the country plough and the *Edekunte* (an interculturing implement on the pattern of the blade harrow) and the yields have been compared with strips which do not receive any interculture. Here again the results point to the advisability of giving interculture to the ragi crop.

There are various methods in vogue of sowing ragi, some more common than others. Broadcasting is the most common, drilling is also practised, ragi is sometimes transplanted in rows, and in an other method called 'haku' ragi the seed is mixed with a certain amount of dry and powdered cattle manure and this mixture is sown in rows. To find out the merits of these various methods of sowing experiments have been undertaken. In a series of 1/20th acre plots, every fourth plot is sown broadcast and these plots are used as check plots. The three plots in between two check plots are respectively given up for the three other methods of sowing. It has been noticed that the transplanted and "hak" plots give good results only in years of plentiful rainfall, whereas in ordinary years the drilled plot comes out best.

In addition to these experiments, trials are made with different varieties of ragi—both those that are bred on the farm and those that are obtained locally. The variety known as Mg. I-5 has so far given the best results and this variety is being distributed on a fairly extensive scale.

Paddy.

The importance of determining with some degree of accuracy the extent of land that can be put under paddy, with reference to the amount of water available for irrigation has been realised and experiments are being conducted to arrive at some data for this purpose. Technically these investigations are known as "Duty of water" experiments. For this purpose, a series of 1/10th acre plots are taken, and after paddy seedlings are transplanted, measured quantities of water are given to these

plots at different intervals, allowance being made for water received by the plots in the form of rain. Thus, the plots receive water once in 4, 8, and 12 days respectively. The quantity of water given varies with the condition of the plot at the time of watering. These experiments were taken in hand last year, and nothing can yet be definitely said about the results.

The effect of various manures are being tried on paddy. This experiment is divided into two parts. The first part consists in comparing the effect of green manures applied alone and combined with bone meal with the effect of a bulky manure like farm yard manure. For this purpose, a series of 1/10th acre plots are taken, every fourth plot in the series receiving no manure and being utilised as check plots. The three plots between two consecutive check plots are then treated with farm yard manure, sann hemp green manure and hongey leaf green manure. The next three experimental plots are given those same manures combined with bonemeal and the whole series is repeated. The indications so far all point to the superiority of green manures over farm yard manure. There is not much to choose between the green manures themselves ; but sann hemp seems to do slightly better than hongey leaves.

The second part of this experiment consists in the comparison of the effects of the various chemical fertilizers on paddy. For this purpose a series of 1/20th acre plots are taken. Every third plot receives cattle manure at 10,000 lb an acre and these are the check plots, the plots between the check plots being treated with calcium cyanamide, ammonium sulphate, superphosphate, alone and combined with one another and with potassium sulphate, The calcium cynamide has been specially introduced to find out its effect on the paddy crop in view of the possibility of its manufacture on a large scale in the province in the near future.

It is believed that ordinarily too much seed is sown with the result that the seedlings that are planted are not very vigorous and also the seedlings planted rather close. Therefore a series of plots have been laid out to find out if the seed rate cannot be reduced. The seed rate that is generally adopted round about is

taken as the standard and this is compared with fractions of this quantity. Thus 80 seers of seeds per acre of transplanted area is taken as the standard and this is being compared with 60, 40 and 24 seers per acre. We find that the smaller seed rates give more robust seedlings and the crop also seems to be decidedly better. Thus there is a considerable saving of seed combined with an increased yield by using a smaller quantity of seed per acre.

Trials are under way to find the difference, if any, in the crop obtained by planting the seedlings at different stages of their growth. Thus seedlings have been planted 25 days, 35 days, and 45 days after the nursery was sown.

Further, different varieties of paddy are being tried both in the summer and winter seasons and the variety that does best in any particular season for a number of years will be distributed to areas with conditions similar to those of this place.

Sugarcane.

Sugarcane being a crop that responds readily to the application of concentrated manures and the supply of oil cake especially of hongey (Pongamia glabra) and castor (Ricinis communis) being fairly plentiful in the State, experiments were undertaken to find out the effect of applying these cakes to sugarcane in varying quantities. For this purpose a series of narrow strips were laid out, every third strip being given cattle manure at 30,000 lbs. an acre and these were taken as the check strips for comparison. The plots between the check strips were treated with castor and hongey cake respectively in one ton and two ton doses, the whole series being repeated three times. Results so far obtained show that superior yields are obtained from the strips receiving the two ton doses, castor giving better results than hongey. Therefore the one ton dose has been dropped and the strips are now receiving two ton and three ton doses to see if the further increase in the manure will also increase the yield and the net profits.

The effect of allowing different amounts of space between successive rows of sugarcane on its growth and yield have been tried on a series of plots. One foot, two feet, and three feet were allowed between two successive rows and it was found that

the three feet spacing gave the best results and this spacing is now adopted generally on the farm. As the experiment now stands the one foot spacing has been omitted and a four foot spacing has been introduced to see if this wider spacing will give any better results. It will easily be seen that a wider spacing means a considerable saving in the seed and added facilities for cultivation.

The sugar-cane in this series of experiments is being rotated with turmeric and results so for obtained go to show that this is a very profitable rotation.

Tests are made to find out the merits of different varieties of cane both local and foreign. Red Mauritius has stood first in yield for a number of years and this is now being multiplied and distributed all over the State. Varieties that do not do well for a number of years are dropped and these are replaced by some of the promising seedling canes bred on the farm.

In addition to the experiments on the principal crops—ragi, paddy and sugar-cane—experiments on a small scale are tried with ground-nut, cowpea, ginger, cotton, pigeon pea and other miscellaneous crops. The nature of these experiments are restricted to the comparison of the merits of the different varieties of these crops at Hebbal.

The above gives only a very short and cursory survey of the Hebbal farm, it being not possible to go into a detailed discussion of the various experiments in the compass of this short article. To those who are interested in these experiments and who desire to have more detailed information regarding these experiments, a hearty welcome to the Hebbal experimental farm is extended and a visit there, it is assured, is well worth the trouble. The departmental officers on the spot are always at the service of inquirers and it is hoped that all those interested in Agriculture will take the earliest opportunity to pay a visit to the farm and see for themselves the various experiments under way.

Besides the crops and the experiments on them as detailed above, there are other features which will interest a visitor to the farm.

As one enters the farm from the road, he will notice a group of new buildings to his right. This is the Veterinary dispensary

recently opened in connection with the Agricultural School. Here are treated animals from the villages round about.

The school does not possess any separate building a portion of the farm buildings being utilized for this purpose. There are three rooms now available to the school. One of these is fitted as a lecture room, the second is fitted up for practical work in botany, zoology and mycology, the third one being utilized for practical work in plan drawing. The necessary apparatus in connection with physics and chemistry classes is stored in a few almirahs kept in the lecture room.

The Students are accomodated in a block of four buildings quite away from the farm buildings. A kitchen and a spacious dining room partitioned off to meet the convenience of various communities with bath rooms attached, is provided. A well with a perennial spring has been excavated for the use of the hostel. The hostel buildings include a reading room and library well supplied with reading matter for the students.

The farm buildings contain in addition to the farm office a small chemical laboratory for sugar cane analysis work, a carpentry workshop where practical instruction in carpentry is given to the students, a barn house with store rooms for storing produce, an engine room where a power driven sugarcane crushing mill has been set up, and where other machinery also find accommodation, an implement shed to accommodate the various implements in use on the farm, a small smithy shop where the students are given practice in smithy work, cooly lines and quarters for some of the officers on the farm. A small dispensary for the use of the students and farm staff also part of these buildings. The Jaggery boiling furnaces are located close by, where furnaces, pans, mould frames and other improved arrangements can be seen.

Among the ploughs stocked on the farm, the Kolar mission plough is the one most liked by the cultivators. The Verity is a heavier plough and this is the one most used on the farm both in the dry and in the wet areas. The Oliver is very similar to the Verity and both in point of draught and amount of soil turned over, does not differ very much from the Verity. The Meston is a very light plough and is specially suitable for working in wetland.

The Syracuse plough has a bar share instead of the usual kind of flat share. The advantage claimed for this is that in the event of the share getting blunt or otherwise unfit, then the bar can easily be removed and the other end of the bar utilized for the work on hand thus obviating the cessation of work on account of a damaged share. The damaged end can be repaired at leisure. The "Sabul" plough is similar to the Syracuse but is a much bigger one and requires two pairs of animals when working in stiff soils. Reversible or turnwrest ploughs are represented by the Syracuse ploughs, one small and the other big. The ordinary Country ploughs which are very useful in the preparation of land for paddy are also stocked.

The Disc Harrow is the implement used on the land after ploughing. This implement breaks up the clods turned up in ploughing. After the manure has been spread on the field, the discharrow is used to mix the manure with the soil. This implement is also used after a crop is harvested to prevent the soil getting hard and to allow any rain that may fall to soak in. Thus the discharrow is a very useful implement on the farm. When a fine seed bed is desired, finer than can be obtained by the discharrow, the Acme pulveriser is used. The log harrow and blade harrow are also on view, though they are not much used on the farm.

The Country seed drill is used for the sowing of ragi on the farm and an adaptation of it with 4 tynes 1 foot apart for sowing groundnut and cowpea. The "Clipper" seed drill is an improved American seed drill with 5 coulters and a hopper for taking in the seed. This was originally constructed for the sowing of wheat, oats, etc,. A few modifications were necessary before this implement could be used for ragi. It has now been so modified that we can sow from 10 lbs. of ragi upwards per acre.

For interculturing crops, we have a Planct Junior implement. This is adjustable and can be worked only between rows two feet or more apart. The indigenous interculturing implements-miniature blade harrows, sometimes with the blade cut out in the centre are used for cultivating crops in rows from 7" to 12" apart.

The machinery on the farm consists of a few oil engines, some for working pumps for lifting water, one for working the power sugar-cane mill, and one for working the power threshers. The threshers are of the " Pennsylvania " pattern and have been found to be very satisfactory. A few hand winnowers of various patterns are in use and all of them do good work. Bullock driven cane mills are also stocked. This is the mill manufactured by the Nahan foundry of the Punjab. The Central Industrial Workshop has manufactured mills on this pattern which are being tried on the farm. Chaffcutters are represented by one made by Messrs. Kirloskar and another by the Syracuse Company.

The Spalding deep tilling machine, a discplough ploughing to a depth of 18 inches and a disintegrator for powdering oil cakes, have also been in use; these have now been sent to the farm at Hiriyur where they are reported to be doing very useful work.

A Rajah Reaper is on view on the farm and has given good results.

Further on come the dairy buildings, consisting of rooms for separating and butter making, the stalls for the dairy cattle, feed rooms, calf pens and so on. Practical instruction in daiying is given to the students of the Agricultural School; and freshmilk is sent to the city for sale after meeting the needs of rhe farm and school, and some butter is also sent out to up country stations. The herd which consists of both buffalos and cows comprises only 17 head all told, a number which on account of the limited area of the pasture land (about two acres) cannot be increased.

Plant Breeding work at Hebbal.

The object of the present " Plant Breeding " work at Hebbal is to provide the Mysore ryot with good seed and it is our ideal to evolve for him better strains than the ones he has at present. For this purpose two of the most important crops have been selected for improvement *viz.*, Ragi and sugarcane. Work on these two crops was started in 1913 and some useful results have been already obtained; other crops like castor, Avare and

groundnut have also been taken up and they are under observation for the last three years for preliminary work.

Ragi was selected as it is the most important dryland crop in the state and is the staple food of the major portion of the population. There are more than two million acres of Ragi in the province and every locality has its own type of Ragi. In most cases it is grown in mixed state and it is rarely seen to consist of one type in any locality. Some were said to be superior to others but there was no definite information about these various types. These types bear different names in different localities and the same name is applied to different types. It was therefore found necessary to test and purify all the local types. Hitherto more than two hundred collections from the Districts have been tested and classified. In order to see if there were any valuable varieties outside Mysore a large collection of nearly 120 types have been procured and tested. So far the results have been that the various collections show themselves to be similar to the standard types and are capable of being brought under definite classifications and that the local types seem to be superior to the North Indian and Deccan types.

Out of the various collections the best ones have been purified and it was found in the earlier stages of the work that Ragi is merely a self fertilized plant. With the help of this information further work was pushed on. When a few of these purified seeds were tested against their mixed stock of seed it was found in every case that the pure seeds gave higher yields than the mixed stock of seeds.

From the pure seeds individual selections were made and these plants were sown in the next season in separate rows. They were tested against rows of the best local type and only such of those that were better than the local type were selected for further trials. In the final trials the varieties are sown along with the local types and repeated a number of times to get average yields. Their yields are compared with the yields of the local type for final selection. The best types are multiplied and distributed to the Districts for trial on large areas under different conditions. They are mostly grown by landlords under the supervision of the Departmental officers. The most successful

of these types are distributed to the ryots on a large scale. So far the results have been very encouraging and at present a few of such " Pedegree Seeds " have found favour with the ryots and a large quantity of seed is available for distribution in the Disticts. The best season to see the different stages of work in Ragi Breeding is in September and October when all the types have fully flowered.

Sugarcane is one of the important money crops in the province and there are nearly 40,000 acres under this crop at present. Though our Mysore Pattapatti is a very rich cane it is unfortunately poor in vigour and its fiber contents low. Further within the province there are typical zones of climate and rainfall which influence plant growth and crop production. It is to provide these various localities with suitable sugarcanes this work has been started. So far a large number of varieties have been tested and of those the most prolific one, Red Mauritius cane, is now being distributed all over the State. Any new cane we may introduce will have to give us larger tounage of jaggery than Red Mauritius cane. Till now no other foreign cane has beaten the Red Mauritius cane. But along with the introduction of foreign canes work on seedling canes also was started and at present there are a large number of seedling canes on hand which are quite superior to the local Pattapatty cane in vigour and richness but only a few of them seem to be superior to Red Mauritius cane. They are being tested on a large scale on all the Government farms and they would be ready for distribution in a year's time. The various stages of growth of the seedling and the cane tests might be seen during December and January on the Farm.

In addition to the study of castors, avare and groundnuts local vegetables also have been taken up for observation and study. The information gathered so far in connection with these crops is very promising. Indigenous grasses have been isolated and grown as pure cultures. The pure cultures have shown that a few of them are peremials and produce good hay. Further work in this line is being continued.

Sisal Hemp Nursery, Sunnakal Farm, Bangalore.

Fibre yielding Agaves in the Economic Garden, Lal-Bagh, Bangalore.

SISAL HEMP AND ITS CULTIVATION

BY

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Introductinn.

THE plant from which Sisal fibre is produced belongs to the genus of Agave of the natural order Amaryllideæ. There are several species which are all indigenous to Mexico and Central America. They are now found in most tropical and sub-tropical countries in Spain, Italy Africa, Western Asia, and India. They are supposed to have been introduced into India by the Portuguese. Roxburgh first observed Agave Cantula in the Botanic Garden at Calcutta. Then Dr. Francis Buchanan found it in Mysore. The following is from the "Journey" (London 1807) [March of 6th May 1800, Baydamangalam to Tayculam]. "The natives here plant also many aloes (Agave vivipara) in their hedges and use the leaves for making cordage. It forms a strong defence against both man and beast, and thrives better in the arid soil of Mysore than in any other place that I have seen; its Canarese name is Ravana Meshid." The other Canarese names are 'Bhutale' and 'Bhudukattale.'

Some species of Agave form important economic plants. Their cheif product is the fibre commercially known as American Aloe. It is this trade name which causes the Agave to be confounded with the Aloe (ord. *Liliaceæ*) which it resembles in having a crowded whorl of thick, fleshy, prickly leaves but from which it differs in that the majority of the species have only a short stem hardly rising above the level of the ground. The chief botanical difference is in the position of the ovary, this being superior in the Aloe and inferior in the Agave. Most of the Aloes are natives of West or South Africa, whereas Agaves are indigenous to Central America. Aloes are chiefly noted as a source of a drug, while the Agaves are known for fibre.

Agave plants take 10 to 50 or even 100 years to flower. Hence they are popularly called the Century plants. When about to flower, an axis is developed from the centre of the

rosette of leaves, which attains a height of 15 to 30 feet. It produces flowers from subdivisions and continues to do so for over a month. After flowering the plant dies but suckers spring up from the roots.

Plants of the Agave family are both ornamental and useful. Their fleshy leaves, often decorated with spines and prickles, are veary handsome. Agave americana variegata, A. lurida, A. filifera, A. Woodrowii, A. ferox and A. polyacantha are some of the garden plants which are very effective either planted singly on lawns or in groups. Some varieties of Agave americana are used for hedging railways, fields, gardens and plantations. They also yield various products such as gum, spirit, liquor, sugar, vinegar, soap and medicine. Above all the most important product which the Agaves yield is their fibre. Agave Wightii, Agave Cantala, Furcrofa gigantea (green aloe-Mauritins-Hemp) and most important of all, Agave Sisalana, yield very good fibre which is used in the manufacture chiefly of binder twine, cordage, etc.

The name Agave Sisalana, Perrine, has now replaced that of Agave rigida, var. sisalana. Sisal Agave is different from the plant usually known as Agave rigida in gardens. Agave rigida is spineless but Agave sisalana sometimes has spines on the edges. Agave Sisalana is the name given by Dr. Perrine to the plant which he introduced from Yucatan into Florida about 50 years ago. It has derived its commercial name from Sisal, a port on the coast of Yucatan and the chief outlet for the fibre of Merida district. Sisal has been extensively cultivated in Yucatan, Florida and Bahama Islands and recently in Australia, Fiji, Hawaii, Philippiness and German East Africa.

Past History.

Sisal was first introduced into Mysore in 1892 when the late Mr. Ricketts, acting on the advice of Mr. J. Cameron, the then Superintendent of Government Gardens imported 5,000 plants from Florida. It is interesting to note that just about the same time the Government of Bengal got Sisal into North India from Kew through the efforts of Sir George King who was then the Superintendent of the Royal Botanic Gardens,

Calcutta. The Agri-Horticultural Society, Madras received 24 plants from Kew in 1890 from which a lot of plants were propagated and distributed in the Madras Presidency. Two plants seem to have been sent from the Society to the Mysore Government Gardens but nothing is known of them. However, the plants imported from Florida were planted in the Lal-Bagh garden in an open field which was under dry cultivation before. This plot which is about 12 cents in area still stands under a thick mass of Sisal from which several lakhs of plants were raised and distributed to different places in and outside the Province. The bulk of the plants have been purchased by planters but Mysore raiyats have not been much attracted by Sisal.

A series of experiments were conducted in this department five years ago with a view to determine the quality and quantity of fibre contained in the leaves of different species of Agave such as Agave Americana, Furcrofea gigantea and Agave Sisalana. The fibre was separated from the surrounding cell mass by retting or steeping in water and beating with a mallet. Fibre was extracted from 887 Sisal leaves and the stuff was found to be excellent. The weight of 100 leaves of Sisal on an average was 201 lbs. and the weight of fibre extracted from them was 7lbs. and 11¼ oz. This works out a percentage of 4 of fibre which perhaps may be raised even to 5 with better means of extraction. At 800 plants per acre and at 20 leaves from each plan per year, we get 16,000 leaves, taking at least 7 lbs. of fibre per 100 leaves, the yield will be 1,120 lbs of fibre. In Florida, Hawaii and Philippines the average yield is 1000—1200 lbs. per acre. At Hindupur the yield has found to have been only 300 lbs per acre. We may infer from this that excessive dryness is against Sisal though imperfect method of extraction may partly account for the low yield. The value of this fibre was estimated at Rs. 480 per ton before the war. The price has risen enormously now and Mexican Sisal is quoted at 75 s. per cwt. or £ 75 or Rs. 1,125 per ton. The fact that this Department has sold 1,40,000 plants recently shows that the Sisal plantation is being taken up on a large scale by capitalists near Bangalore.

Cultivation.

Sisal like all Agaves, is very hardy and resists drought to an extraordinary degree. It can be successfully grown on soils which are too poor for the cultivation of any sort of dry crop. Waste lands and worn out soils will do well but dry calcareous gravelly soils are eminently suited for Sisal plantation. On such a soil Sisal will grow for several years without poling. It must be remembered that early poling is what the Sisal planter has to combat. Swampy and ill drained lands are not suitable. Rich soils should also be avoided as on them the leaves develop a large percentage of pulp and very little fibre; moreover the plant rapidly grows into maturity. Open land should be selected and to work the industry economically it is desirable to have a large area. The plantation should be laid out systematically. It would be convenient to have a fairly level land where light railways could be laid out as the weight of green leaves is very large in proportion to the yield of fibre and their conveyance from different parts of the plantation to the factory involves considerable labour and expense. Good supply of water is also required for washing the fibre during the process of milling.

It is propagated by root suckers and bulbils borne on the peduncle or flower stalk. The plant reaches maturity in 10 to 20 years when a pole 12 to 24 feet in height grows out from its centre, on which a number of blossoms appear, borne on arms which extend laterally from the upper part of the pole. In about 6 months after the appearance of the pole, bulbils which develop into young plants appear verying in length from 2 to 4 inches, about 1,000 to 2,000 in number. The bulbils are gathered and set out about 6 inches apart each way in nursery beds. After flowering the plant dies but suckers are thrown out from the roots so that the death of the parent provides an immediate progeny. Suckers are also produced in the parent plant from the 2nd to the 4th year in numbers, many plants producing as many as 20 suckers during that period; after this they begin to decrease until they finally cease to appear. Bulbils from old plants that have been regularly cut and suckers from plants which have poled should not be used for propagation as they are likely to pole early.

FLOWERING OF SUCKER AFTER THE PARENT PLANT HAS POLED.

In Mexico, the plants are usually spread on the ground for two or three months to partially dry them as they are apt to root if planted at once. Dry leaves at the bottom of the young plants should be removed while planting. The plants may be put down 7 feet from each other in rows 8 feet apart. At this rate it will take 800 plants to an acre. They could also be planted at different distances such as 6′ x 6′; 7′ x 7′. It would be convenient to have a wider space of about 12 feet between every 4th or 5th row. Interspaces are cultivated with pigeon pea, corn or cotton in Bahamas. The slight shade afforded by these crops is beneficial to Sisal and they also help in keeping down the weeds.

After planting is done very little attention is required. Big weeds may be removed. All the root suckers which are produced by the plant should be carefully taken off or the leaves will deteriorate and the plants get exhausted resulting in their premature flowering.

The leaves will be ready for cutting in the fourth and in some cases the fifth year. Early cutting is said to render the plants less liable to premature poling. The proper time to cut is when the leaves are found at right angles to the stem. Cutting immature leaves induces early poling and as the plant is weakened the leaves subsequently borne are smaller and fewer. On the other hand the cutting should not be delayed till the leaves get over-mature when they droop down and look yellowish, as the fibre from such leaves will be weak. On the cutting of the leaves depends to a large extent the life of the plant; if they are not cut, the plant will pole before time and once poled the hemp become dry. The cutting of the leaves could be done for 12 to 16 years when the plant flowers and dies and it can be made almost continuous on a plantation by planting in the interspaces when the plants begin to pole. The leaves ought to be about 4 to 5 feet in length and they should be cut close to the stem. Each plant produces at least 20 leaves in a year and one man can cut 1,200 leaves in a day. Sisal leaves are easy for harvesting as most of them have no side teeth. The terminal spine has to be cut off.

Fibre extraction.

One of the chief considerations in Sisal industry is the means of extracting the fibre. The leaves are steeped in water, then beaten and scraped to remove the non-fibrous portion and washed and sun-bleached. They are also crushed by machine to break the hard surface and express the juice, then pounded with a wooden mallet till all the ligneous matter is removed, washed and sun-dried. Another method is to lay the leaves on a board and scrape them with a wooden fork till all the pulp is removed ; the fibre is then bleached and dried in the sun. These methods of extraction of fibre by hand are very slow and tedious. To work the industry on a commercial scale some sort of machine has to be used and in this connection Sir Daniel Morris, Commissioner of Imperial Department of Agriculture for the West Indies wrote as follows :—"In regard to machinery for the treatment of fibre plants such as Agave Sisalana there appears to be a thoroughly satisfactory machine in use in the Bahamas which will clean about half to threequarters of a ton of fibre per day. This machine is manufactured by T. C. Todd of Patterson, New Jersey, U. S. A. The machine itself is of considerable size and weight and costs from £500 to £600. It is usually driven by an oil engine 4 to 5 horse power. I believe the total cost of machine and oil engine with all necessary fittings is about £1,000. As far as I am aware, there are no small machines that can be depended upon to turn out first class fibre from Agave leaves. These, as you are aware, are so large and heavy that a powerful machine is absolutely necessary to deal with them. I have no confidence that any hand power machine could be constructed sufficiently strong to clean any full sized Agave leaves, such as could produce good commercial fibre." In German East Africa where Sisal Hemp industry is done on a large scale the machine employed for the extraction of fibre is the "Molla" which is also used in Yucatan. Its price is £650 and is capable of dealing with 100,000 leaves in ten hours and requires 48 Horse Power to drive it. In order to keep this machine sufficiently employed a plantation of at least 600,000 plants is necessary. This represents, at 800 plants to an acre, an area of 750 acres. Messrs : Burn & Co., of Bengal have also a

Decorticating Machine for Agave leaves. It takes about 25 leaves per minute and as they pass through, a powerful jet of water is directed on them to remove all the pulp sticking to the fibre. This Machine gives a result of 4% of long dry fibre at the rate of 1 cwt. per hour.

Sisal fibre is used chiefly for making binder twine, and cordages. and rope made of Sisal are stronger and more durable, lighter and more pliable than those made from other hemp.

Disease.

One other point to be considered is whether the Sisal plant has any diseases. For some years a disease has been found on the Agave (including Sisal) in India, the injury being in most cases confined to the leaves on which are produced small circular patches which eventually turn black and form a hole which spoils the fibre. A similar condition has been found in German East Africa where it is said to be due to excessive heat. This disease in India has been found to be due to the attacks of a fungus. It is noticed on a few leaves of Sisal and other Agaves in the Lal-Bagh and in Sunnakal Farm here. Sometimes cracks are found in the leaves of Agave especially after a period of dry weather; such cracks would afford a ready means of infection from spores carried by wind. Collecting and burning diseased leaves, the prevention of accidental injury to the leaves and spraying with Bordeux mixture are the methods recommended as likely to be efficactous in checking the disease.

Waste products.

Lastly we should consider whether we could get anything out of the refuse of Sisal. The leaf contains 4% fibre, 50% water 46% vegetable and mineral matter. The pulp which contains sugar may be used mixed with other ration as a feeding stuff for stock. But it would be better to return it to the soil in the shape of manure either as such or in the shape of ash. It is estimated that the value of the waste for manurial purposes is about Rs. 20 per ton.

Conclusion:—No note on any crop is complete unless the cost of cultivation and the yield and profit are stated. So I shall conclude this with a few figures which can only be approximate.

For the purpose of calculation the period of Sisal plantation is taken to be 16 years.

	Rs.
(1) Cost of 1,000 plants (800 per acre, 200 to make up for casualities)	25
(2) Cleaning land and planting an acre ...	35
(3) Protection at Rs. 10 an acre for 16 years ...	160
(4) Cutting at 20 leaves per plant for 12 years 1,92,000 leaves	70
(5) Conveying leaves to the factory and extracting fibre, at ½ a ton per acre for 12 years and at Rs. 150 per ton ...	900
(6) Supervision at Rs. 10 per acre	160
(7) Contingencies	220
	... 1,600
Value of 6 tons fibre at Rs. 600 per ton (though it is now selling at over Rs. 1000 a ton)	 3,600
Deduct cost of production ...	... 1,600
Net profit for 16 years ...	... 2,000

This works out at the rate of Rs. 125 per annum per acre. It must also be noted that in this case the rent of the land and the interest in the capital outlay and depreciation charges on the machines, which after all will not amount to much when the industry is worked on a large scale, are not included in view of concessions now granted by the Government of His Highness the Maharaja of Mysore who are so anxious to help the people of the State by encouraging the cultivation of Sisal hemp.

Some Cost Accounts of Sugarcane cultivation in Bangalore.

BY

(1) B. Srinivasa Iyengar,

Jodidar, Anekal.

(2) Rev. Father Fysandar,

Bangalore.

(EXTRACTED).

So rarely do our farmers maintain a correct and detailed record of the expenses and income of the cultivation of the various crops they raise and so rarely do the few such records as may be kept by enlightened farmers see the light of day that the figures presented in the following brief note should be found specially valuable and interesting. The accounts relate to sugarcane areas in the Bangalore District, viz., one situated in the Anekal Taluk within five miles the town of Anekal itself and owned by Mr. B. Srinivasa Iyengar; the second situated in the Taluk of Bangalore itself within 6 miles from the city and owned by Rev. Fysandar. Both the areas are farmed in the manner in which sugarcane cultivation is carried on by the large majority of sugarcane farmers in the District. That is to say, the lands are situated immediately below irrigation tanks of average capacity and depend for their irrigation upon the water of such tanks supplemented, may be, by a few temporary wells dug to supplement the tank irrigation, at critical times.

The cultivation depending thus upon a purely rainfed tank, sugarcane is not grown every year invariably on a definite area but only in such years and in such areas as may be decided by the amount of rainfall in the north-east monsoon preceding.

The system of farming is the following :—

The sugarcane area is divided into a large number of small strips ranging from as low as one-sixteenth of an acre upto about one-fourth acre, each strip being cultivated by a separate tenant.

Thus in estate No. 2 the area was farmed by 28 tenants each of whom planted canes of the number shown against them in the following table, 8,000 sets being usually required to plant one acre in this neighbourhood.

TABLE I.

Season 1908.

Tenant	No. of sets planted	Total
5	2,000	10,000
2	2,500	5,000
13	1,000	13,000
1	1,500	1,500
1	500	500
2	925	1,850
2	250	500
1	150	150
1	200	300
Total ... 28	...	32,800

The arrangement between land-lord and tenant is very varied, the share of the land-lord depending upon the demand for the land as influenced by the number of ryots possessing no irrigable land and by the certainty or otherwise of raising a profitable crop. The tenant sometimes bears all the expenses and pays to the land-lord a share varying from one-sixth to one-fourth of the total of the gross produce ; or the land-lord and tenant divide all expenses other than those of the actual cultivation of the land which is provided, of course, by the labour of the tenant, and divide the produce as well equally between themselves ; or again the land-lord may bear the full cost of the oil-cake manure and half the other expenses to entitle him to a half share of the produce. In all cases the actual labour both manual and bullock is all the tenant's. He does the plowing, digging, carting of manure, planting of canes, the weeding, wrapping, irrigating, etc., he cuts the cane and carts it to the milling shed and his bullocks work at the mill and he assists at the milling shed. Likewise also the assessment and other dues to Government are borne by the land-lord.

In the Anekal Estate as may be seen from the following table, in the year 1916-17 the land-lord merely received a quarter share of the produce, all the expenses being borne by the tenant who took the remaining three-quarter share of the produce. In the other years and in the different areas specified, the land-lord and tenant have divided the cost of some items of expenditure viz., the value of the oil-cake, and the cost of milling and manufacture equally and each took one half of the produce.

TABLE II A.

Anekal Estate.

Serial No.	Year	Area in acres and guntas	Gross returns	Half of total expenses being the owner's share of expenditure				Net returns		Remarks
				Oil cake	Manure	Milling expenses	Mis. expenses	Total expenses	Total	Per acre	
			Rs. as. p.	Rs. as. p.	Rs. as. p.	Rs. as. p.	Rs. as. p.	Rs. as. p.	Rs. as. p.	Rs. as. p.	
1	1915—16	2	762 6 3	81 13 9	59 4 6	14 11 5	52 9 5	208 7 1	553 15 2	276 15 7	
2	1916—17	0—36	482 11 4	No expenses incurred by owner this year to portion of the gross return was the net return of the owner.					120 10 10	132 11 11	
3	1916—17	1—31½	554 15 6	47 0 0	38 12 0	15 5 0	46 13 0	147 14 0	407 1 6	203 8 9	
4	1916—17	2—38	142 7 2	84 1 4	57 3 0	5 14 0	10 8 0	157 10 4	...	Loss	15 3 2
5	1916—17	0—32	129 12 2	20 2 8	17 12 0	4 2 0	11 4 0	53 4 8	76 7 6	38 3 9	
6	1917—18	2—20	643 11 9	217 13 0	104 1 6	26 10 8	42 8 4	391 1 6	252 10 3	126 5 1½	
7	1917—18	2—0	685 7 7	98 4 5	88 6 6	24 2 11	57 14 8	268 12 6	416 11 1	208 5 7	

TABLE II B.

Bangalore Estate.

Year	Gross returns	Land lords Gross Share	Land Lord's Expenditure				Total expenses	Net-return to Land-lord		
			Oil cake	Cattle Manure	Sugar cane setts	½ milling charges		Total	Per acre	
			Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	
1907	1606 3 4	803 1 8	400	80	48	3 6 10	531 6 10	271 10 10	.77-14-6	
1908	1288 10 8	644 5 4	325	65	39	7 15 4	436 15 4	207 6 ...	Area not Specified	
1909	2667 10 7	1333 13 3	625	125	75	12 5 ...	837 5 ...	496 8 3	130—7-0	
1910	2664 14 5	1312 7 2	600	125	72	5 5 9	797 5 9	515 1 5	85-13-5	

In the Bangalore estate, the arrangement is different. The land-lord pays the full value of the oil-cake manure, the full value of the seeds, half the cost of milling and manufacture, and gets a half share of the produce. This we should say is the more common of the two. The following account with two tenants is a specimen.

TABLE III.

Tenant	A				B				C				D			
Total produce	43 mds.				68 mds.				27 mds.				45 mds.			
Value	90—11—6				146—10—0				45—15—6				85—14—9			
	Credit			Debit			Credit		Debit			Credit		Debit		
	Rs.	A.	P.	Rs. A. P.	Rs.	A.	P.	Rs. A. P.	Rs.	A.	P.	Rs. A. P.	Rs.	A.	P.	Rs. A. P.
Half value of produce	45	5	9		73	5	0		22	15	9		42	15	4	
Hire of Mill ($\frac{1}{2}$)				0 12 4				1 6 0				0 15 8				1 2 0
Cost of manufacture ($\frac{1}{2}$)				0 12 4				1 6 0				0 15 8				1 2 0
Sunkam ($\frac{1}{2}$)				0 1 0				0 1 0				0 1 0				0 3 6
Oil ($\frac{1}{2}$)				0 1 6				0 3 6				0 2 6				0 1 0
Miscellaneous ($\frac{1}{2}$)				0 7 6				0 7 6				0 6 3				0 7 6
Thoti				0 8 0				0 8 0				0 8 0				0 8 0
Debt				20 11 6				21 3 11				31 8 8				130 9 *9
Total	45	5	9	23 6 2	73	5	0	25 3 11	22	15	9	34 9 9	42	15	4	134 1 9

* Advanced on 5 occasions

It is usual also to ensure the service of tenants by advancing small loans to them with or without interest. Permanent laborers and tenants can hardly be secured, indeed, without this kind of accommodation. The account given in the above table with tenant 'D' shows how often ready money has to be advanced to them or help given in the shape grain for food. It is often worth all this and more if good tenants can be secured. Steady hardworking tenants who bestow all the care and attention that the crop needs and all at the proper time succeed in giving their land-lord a better return for the money spent on the land than an indifferent tenant. Though the manure supplied by the land-lord is the same to all tenants and though the land is also fairly uniform in character the yields of jaggory obtained by different tenants on the Bangalore Estate vary greatly from one another.

TABLE IV.

Tenants	Yield of Jaggory Maunds	Number of boilings	Maunds per boiling
1.	34	23	1·5
2.	54	24	1·9
3.	71	31	1·9
4.	50	28	1·8
5.	51	28	1·8
6.	70	35	2·0
7.	71	37	1·9
8.	71	35	2·2
9.	90	38	2·0
10.	87	44	2·0
11.	77	40	1·9
12.	61	30	2·0
13.	34	20	2·1
	1 Md. = 25 lbs.		

The yields of jaggory per acre are figures frequently enquired about. Of course, they vary greatly depending upon a well known variety of circumstances. But as the treatment on these estates is fairly constant from year to year they are interesting. The wide variations show to what extent the uncertainties of the water-supply in the tank affect the yield.

TABLE V.

Year	Area under cane	Yield of Jaggory	
Bangalore Estate		Total	Per acre
		Mds.	Mds.
1907 ...	3½ acres	895	255·71
1909 ...	3½ „	1,381	394·57
1910 ...	6 „	1,281	213·50

Year	Area under cane	Yield of jaggory	
Anekal Estate		Total	Per acre
1915—16 ...	2 acres	780	390·00
1916—17 ...	36 guntas	276	248·40
1916—17 ...	1—31½ guntas	634	352 22
1916—17 ...	2—38 „	163	55·25
1916—17 ...	32 „	148	118·40
1917—18 ...	2—20 „	736	294·40
1917—18 ...	2—	784	392·40
	1 gunta = $\frac{1}{40}$ acre.		

The variation in the price of the jaggory almost from day to day in the Banglore market is a factor which hits many a hard-working ryot very hard indeed. The financial result is often times a gamble, so great is the difference between the price fetched by a ryot on one day and that by his neighbour the following day. The prices in the season 1919 in the Bangalore market are given below :

Thus during this season the jaggory made on the Bangalore Estate was sold as follows :—

2	lots	at	Rs.	2	0	6	2	lots	at	Rs.	2 11 0
3	„		„	2	1	0	1	„		„	2 10 0
2	„		„	2	2	0	2	„		„	3 2 6
3	„		„	2	3	0	1	„		„	2 14 0
3	„		„	2	4	0	2	„		„	3 4 0
1	„		„	2	6	0	1	„		„	3 5 0
2	„		„	2	9	0	1	„		„	3 0 0
2	„		„	2	8	0	1	„		„	2 4 0
1	„		„	2	7	0					

The actual money returns obtained by the land-lord out of sugar-cane cultivation after deducting all expenses exclusive of interest on capital is shown in table No. II.

What does the tenant get for his labor ?

Table No. III gives the value of the tenant's share, as well as the expenses debited to him. It may be mentioned that none of these tenants farm more than $\frac{1}{2}$ acre of sugarcane land. They own considerable dry land in which they raise ragi and other dry land crops.

The expense of making jaggory is also a much discussed point. In the Bangalore Estate detailed accounts are kept of all the items of expenditure other than the labour of the tenants and of their bullocks. The items include even the cost of the betel-leaves and nuts supplied to the workmen.

The cost of manufacturing jaggory, can be seen from the following table. The amount varies from annas 1—9 to annas 2—11 per maund. Of course neither the tenant's labor nor that of his bullocks nor that of the fuel is reckoned and all these are extra. It may be mentioned that the charge includes twice the amount of the hire charged for the sugarcane mill, pans and other utensils in the milling shed, i. e. half the amount of the total hire is borne by each party. As a matter of fact the outfit is owned by the landlord himself who charges a somewhat arbitrary amount as the tenant's share of the hire of the mill, etc.

TABLE VI.

Maunds of Jaggory	Cost charged to Tenant	Twice of Column 2	Cost per Maund.
	Rs. As. P.	Rs. As. P.	Rs. As. P.
34	3 2 1	6 4 2	0 2 11
45	3 5 10	6 11 8	0 2 4
59	3 12 9	7 9 6	0 2 1
50	3 6 4	6 12 8	0 2 2
51	3 12 4	7 8 8	0 2 4
70	4 7 10	8 15 8	0 2 0
71	4 9 1	9 2 2	0 2 0
71	4 1 5	8 2 10	0 1 9
75	4 7 3	8 14 6	0 1 10
87	4 11 5	9 6 10	0 1 8
77	4 4 5	8 8 10	0 1 9
61	3 10 9	7 5 6	0 1 11
43	3 5 1	6 10 2	0 2 5
794	51 0 7	102 1 2	0 2 0

(Figures from other sugarcane growers will follow in the succeeding issues of the Journal. Editor.)

Some Practical Hints on Butter making by the use of the Cream Separator and the Barrel Churn.

BY

T. Rangasami,

Dairy Inspector, Hebbal Dairy.

BUTTER may be made from (1) whole milk (2) cream.

1. *Whole milk.*—This is the common practice prevailing in our rural parts. Milk is boiled well over a slow fire until a thick layer is formed on the surface, then allowed to cool down to 130—135° F when a small spoonful of soured butter milk is added to start fermentation. It is then kept overnight in a warm place undisturbed until it forms a thick solid mass called curds when it will be ready for churning.

Churning of curds is done in the country churns only (Kadagolu or malnad churn). It is usually done by two ways—(*a*) churning the whole mass straight away, (*b*) collecting the top layer or the fatty portion and churning once in two or three days. By the former method, the buttermilk will be thin and we cannot expect a profit by its sale, whereas by the latter, the thin butter milk is made use of for adulterating the curds by the professional men.

2. *Cream.*—Cream may be separated either by—(*a*) Gravitation or (*b*) centrifugal force.

(*a*) The first method is the old fashioned one of putting milk in shallow pans and allowing it to rest. Cream accumulates on the surface owing to the rise of the fat globules in milk. The cream is allowed 12—15 hours to rise and is then skimmed off. A second skimming is also taken if any left unskimmed. There is a great loss of fat by this method besides the skim milk which goes sour by its long standing.

(*b*) Separation of cream by centrifugal force is done by using cream separators which is now the prevailing method. The advantages of using cream separators are :—The skimmed milk may be used for domestic purposes just like the whole milk. (2) 98 to 99% of the fat in milk is removed if the machine is properly adjusted and worked. Raw milk, direct from the udders of the animals is used for separating.

After separating the cream, it should be ripened to the proper degree to obtain butter of good quality. Cream is ripened (1) Naturally (2) by the use of some pure lactic cultures or starters. This may be either the previous day's sour cream or some lactic ferments available either in the form of powder or of liquid.

(1) Where cream is ripened naturally, it is just left till it ripens of its own accord and is frequently stirred to let in air for the proper development of bacteria

which bring about the souring. The time taken by cream in ripening varies according to the temperature and the nature of the cream, about 12-15 hours in summer and 24-30 hours in winter may be said the usual time. Thick cream takes a longer time to ripen than thin cream owing its having more fat.

(2) To hasten the fermentation, and to get fine flavour in butter, ready made starters or the previous days ripened cream or butter milk is is also added. The souring takes about 12 hours according to the temperature.

The taste and smell of the cream indicates when it is properly ripe and experience will tell when it is to be churned to get butter of good quality. Ripened cream should have a uniform consistency and a plesant acid taste. Underripened cream gives butter of low quality and of a less quantity, and overripened gives soft and rancid smelling butter.

Churning.

We have seen how cream should be treated prior to churning and we now come to the churning itself. Butter made from cream must be made in an atmospheric churn. These churns are now available in India and many are in use in our parts. The first thing to do is to thoroughly cleanse all the utensils namely—the churn, the butter worker, the scotch hands, etc., first with boiling water and then with cold water. The churning should be done at the proper temperature. Early morning before sunrise is preferable as the temperature is lower than after sunrise. The churning temparature depends on a variety of circumstances. A lower temperature is used in summer than in winter. In summer, the temperature should be 60—65° F. and in winter 65—70° F. Too high a temperature in summer means soft butter.

The cream is now in the semi-solid or something like a paste form, which should be thinned uniformly by adding an equal quantity of water. In pouring cream into the churn, cover the top of the churn with a clean muslin cloth and pour the cream through. Fill the churn one-third full and not more.

Now, turn the churn very slowly at first and ventilate frequently as, if the expanded air in the churn be not released, the cream gets into a frothy condition, goes up in temparature and gases are forced into the cream ; ventilate frequently at first and increase the speed to 40 or 45 revolutions per minute. 60 revolutions or any other speed as prescribed by the manufacturers of the churn should not be followed blindly, as the rapid revolutions make the butter soft and greasy. The splashing or the beating sound of the cream inside should be clearly heard when the revolution of the churn reaches the maximum. Keep on turning until the cream begins to break ; this you can tell, after some experience, by the change of noise in the churn.

The butter is in fine grains and the small glass window in the churn begins to clear, then you know that butter is forming and it is time to stop. The churning takes about ½ an hour but varies according to the temperature and season. Just when the cream begins to break or when the butter globules appear on the glass like grains or sand, open the lid, dash cold water into the churn. Water is added at this point to effect a change of temperature in the churn, and secondly to give the granules more space and harden them. After the addition of cold water, put on the lid ; churn a little and ventilate once or twice, then stop churning altogether. If you continue to churn, lumps are formed and if this results, it is not easy to wash the butter milk out of the lumps.

Next, let off the butter milk, let it run through a sieve over which a muslin has been placed to catch any particles of butter which may come through and these particles are then put back into the churn.

Washing the Butter.—For washing very cold water must be used as it hardens the butter to a certain extent. In small dairies located for away from the towns and cities where ice is available, it is advisable to store water in earthen pots and exposed to the cool open air. This water will be decidedly cooler than freshly drawn well water or tap water. For washing, pour in enough water to float the butter in the churn. Give the churn two or three gentle turns and drain off the water mixed with butter milk,

and then put in some more fresh water and let it off. A few more washings may be given until clear water (without milky colour) comes out of the churn.

Salting.—After washing the butter should be salted for table purposes. Salted butter commands a good market than unsalted. Unsalted butter is mostly used for converting into ghee. There are two methods of Salting the butter *(a)* Brining *(b)* Dry Salting.

(a) Brining.—The butter is allowed to remain in brine for about 30 minutes. Suitable brine is prepared by disolving one pound of table salt in 8 or 9 lb of water. The object of brining is to harden the butter and lower the temparature of the churn. The advantage of this system in summer is obvious. Brining also helps the removal of butter milk, and so preserves the butter, and the butter is salted uniformly. Brining however, is more expensive, and is confined to small dairies where 5 or 6lb of butter is prepared at a time.

(b) Dry Salting.—After washing the butter in the churn it is removed to the butter worker. The object of the worker is two fold;—first to bring the granules together without destroying their form and Secondly to get rid of superfluous water. Soft butter should not be worked as there will be a great wastage by adhering to the sides of the worker. The best thing to get rid of superflons water in soft butter, is to wrap it in wet muslin and keep it on a cold marble slab or over a brick saturated in water. Dry salting is done when the butter is on the worker, and $\frac{1}{4}$ to $\frac{1}{2}$ oz. of salt per lb is usually added. Powdered table salt is sprinkled over uniformly and reworked carefully without destroying the granular structure of the butter.

Preserving Butter.—Well washed and uniformly salted butter will keep for about 8 or 12 days provided it is kept in a cool place. It is beyond the reach of all the dairy farmers to equip the dairy with refrigerating chambers for storing the dairy products. In small dairies where only a small quantity of butter say 8-10 lb a day is produced, the following method for storing butter may be experimented with, without incurring any

expenses. This serves as an ice box, and the butter is kept hard and a longer time.

Procure a tin box of a suitable size with perforations on all sides, to hold about 8-10 lb butter with compartments inside. The butter after salting, must be wrapped in parchment or butter paper. (half a pound and one pound packets may be made) Put in all the butter packets in the tin box and close the lid. Now, keep ready about 16 bricks well soaked in water. The bricks should be wrapped with wet muslin cloth. The tin box containing butter should be enclosed with these bricks. The result will be the lower temparature inside, and consequently the butter will be hard and keep longer.

The thorough cleaning of the different appliances before leaving off work for the day is exceedingly important. For this purpose all utensils should be first washed with coldwater using the brush freely. All adhering curd should be thus removed Hotwater should then be used for washing, and after the vessels are quite clean, they may washed or dipped in boiling water and put out to drain.

Paddy cultivation and the use of special manures in Yedatore Taluk, Mysore District.

BY

T. S. Subba Rao,

Land Holder and Union Chairman, Thipoor.

In 1918-19 I cultivated paddy on 13 acres. I purchased and used on this area one ton of the special mixture sold by the Agricultural Department made up of oil cake and bonemeal. The seed paddy I used works out at about 30 seers per acre. The paddy was all cultivated by the transplanting system and not by that of broad casting. The seedlings were transplanted from five to six weeks after the nursery was sown.

I had all my paddy land ploughed with " Meston " ploughs got from the Agricultural Department. The crop came up luxuriantly and attained a height of from $4\frac{1}{2}$ to $5\frac{1}{2}$ feet. There

were about thirty to forty tillerings to each clump and in the earhead some 200 to 300 grains were counted in many individual earheads.

The Yield of the paddy was as follows :—

Sanna Bhatta (fine variety)

Area	$5\frac{1}{4}$ acres	
Yield 56 candies of 180 seers		
Value		Rs. 1176-0-0
Bili Bhatta (White paddy)		
Area	$7\frac{1}{2}$ acres	
Yield 68 candies of 180 seers		
Value		Rs. 1224-0-0
Total *Straw* about 59 cart loads		
at Rs. 8/-a cartload		Rs. 522-0-0
		Total Rs. 2922-0-0

My expenditure on this crop may be estimated at Rs. 850 including assessment of Rs. 65, leaving a net balance of Rs. 2,070.

On this same area the yield prior to this crop was 100 candies while in the season under report it was 124 candies, giving an increase of 24 candies for the 13 acres. The plot of $7\frac{1}{2}$ acres was newly brought under cultivation last year when it gave at the rate of 7 candies per acre and this year at 9 candies, but the plot of $5\frac{1}{2}$ acres of old land yielded at the rate of 9 candies an acre last year and at ten candies this year. I have no doubt that most of this increase in yield is due to the special manuring.

NOTES AND COMMENTS

By the Editor.

The Dairy Trade in Madras.

WE invite the attention of readers to the orders of the Government of Madras sanctioning certain proposals of the Director of Agriculture for the improvement of the Dairy business in the Madras City.

* * *

Sisal Hemp.

We invite attention to the Government Order on the concessions to be granted to those taking up the cultivation of Sisal Hemp within the State, which we publish among our "Selections." The article which has been contributed by Mr. J. C. Javarayya to the current number of the Journal on the same subject, will, we hope be of much timely use.

* * *

The Experimental Farms of the State.

The first of a series of articles on the various Experimental Farms in the State appears in this issue. They will deal with all matters which should interest visitors and others wishing to know about the work on these farms. The Hebbal Farm naturally comes in first, being the oldest and best organised. The Marthur Farm in the Malnad, the Babbur Farm in the Marikanave tract, and the Naganhalli farm in the Cauvery Channel tract will all be described in the succeeding issues. We hope readers of the Journal will find this a useful feature.

* * *

A new green manure.

One of our members Mr. A. MacIsaac of Gangenahalli Estate, Magadi Taluk is introducing the cultivation of a new green manure crop, Tephrosia Candida, also called Boja Medelloa. In his tea estates in Upper India it is said to have exerted very beneficial effect on the tea and on the soil. The crop is unlike any we are used to here as green manure; it grows about five feet high, has a distinctly woody stem, grows in fact more like

a perennial than an annual rotation, catch or cover crop. It sheds its leaves profusely and the ground is covered thick, all grass and weeds being smothered. Its roots are said to extend very deep and according to de Sornay this is one of its chief merits.

The Bar Share Plough.

Our readers are aware that one of the heavy items of expenditure about the popular K. M. plough and those made on the same model is the wearing out of the costly share which has to be replaced every now and then. The plough is however so well made and so very much appreciated that many ryots uncomplainingly put up with this inconvenience rather than take to using any other type of plough. The new type of plough (the D. P. W.)plough with a bar point share, which is also being popularised, overcomes just this very difficulty and though somewhat heavier and less attractive than the K. M. has still done excellent service with many. A striking case is that of Mr. M. S. Linge Gowda of the Vasantapur Estate near Bangalore who uses four ploughs of this type. The bars had been worn to half their length i. e., till about as long as they could be used at all. Each plough had been fitted therefore with a second bar. The lasting quality of the body of the share which carries the bar was remarkable, for in all the ploughs, though the edges were worn thin and sharp, they were still serviceable enough. With the ordinary type of share, each plough would have needed three or four shares for this amount of work involving the cost of that number of shares say Rs. 10. With a little more attention to details in the construction of the plough, it should become at least as popular as its present rival.

A booklet on Rubber.

We invite attention to a very useful little publication entitled "A Guide to the Preparation of Rubber" by Dr. P. Arcus, from the Experimental Station, Malang, Java, Dutch East Indies. Detailed instructions are given regarding the treatment of the latex through all stages from the time of collecting up to the time it leaves the factory as rubber, cured, sorted and

packed. The preparation of Sheet rubber, of crepe rubber, the treatment of inferior, damaged or waste rubber into different forms of second quality rubber are dealt with in detail. The part of the book dealing with "faults" in the different kinds and their causes will be found particularly valuable. These notes are brief and to the point, as the following specimens will show, thus :—

The crepe dries irregularly.—The rubber has not been well mangled with the smooth rolled machine, so that the crepe is not of even thickness.

The crepe becomes darker as it dries.—Due to a process of oxidation ; it can be avoided by using sodium bisulphate and drying quickly.

The smoked sheet has "sagged" and lost its original shape.—The latex was too diluted or the acetic acid was not strong enough. The temperature in the smoke room was too high.

The English translation should be found very useful by the planting community of South India.

* * *

Chopping up Sannhemp for use as Green Manure.

A sannhemp crop grown for being used as green manure has as is wellknown, to be cut up into small lengths before it can be incorporated into the soil except where the crop may have made but poor growth when such cutting up will be unnecessary. A very simple method of cutting up a moderately heavy crop which had grown to a height of some five feet came under our notice and may be of interest to readers. The method consists in cutting the crop into short lengths while it is standing in the field. With a sharp sickle the crop is cut first a short way down from the top, then a little way lower down, leaving a stubble of about a foot in height. The men go about the field hacking and hewing in through the crop till the whole crop is cut down and the field is covered by a layer of chopped up sannhemp ready to be ploughed or dug in. The method saves both time and expense, because in the ordinary way the crop will have to be cut down, carried to some convenient place in or out of the field for being chopped up, and then brought

back and spread over the field all of which mean time and coolie wages.

In the present instance the sannhemp crop was being prepared in this manner for being ploughed into the field as manure for potatoes. In this particular village the practice has become very popular within the last three years, the ryots arranging to get sannhemp seed locally by leaving a small portion of the sannhemp raised for manure, to grow and mature seed.

* * *

Green Manure and Bone Meal.

As related closely to the subject of the paragraph above, attention may be drawn to the work now being conducted in some of the agricultural stations in this country, which goes to show the value of decomposing organic matter in converting insoluble phosphate of lime such as occurs in bonemeal or mineral phosphates into more or less readily soluble forms in the soil. The work of Mr. R. Ramaswami Sivan at the Coimbatore Agricultural College is notable in this connection. The nitrogenous organic matter of bonemeal itself will help to make its phosphoric acid more easily available, than if the phosphate were unaccompanied such organic matter. Reference may be invited to page 25 of the Annual Report of this department for 1905-06 in which the value of bonemeal as a phosphatic fertiliser in a tropical climate is dealt with, and the rapidity of its decomposition sought to be established purely by mechanical means such as measuring the size of the bonemeal particles in the raw condition and after they have remained in the moist well-tilled soil for one season. Bonemeal applied along with green manure should be able to act still more quickly than when applied by itself. As the practice of green manuring either by the ploughing in of green manure crops grown in the field or by trampling in green leaves brought from other places, is general in the Mysore and Kolar Districts, it should be easy for farmers in these districts to take advantage of these results. Bonemeal at the rate of 150 lbs. an acre may be scattered over the puddle as soon as the green manure is worked in. There is such large scope for the utilisation of bonemeal in our state that it behoves us to popularise its use in as many ways as possible.

The Utilisation of Skim Milk.

As readers are aware the Department is popularising the use of Cream Separators and Butter Churns of the barrel ("Champion") type and that there are now several such outfits in use not far from Bangalore. The question of finding a remunerative use for the large quantity of skim milk has become important, for the present methods such as the sale of it as skim milk to the tea houses in the city or the converting of it into curds for sale or disposing of the skim milk by feeding it to calves and she-buffaloes on the farm itself either as skim milk or as curds are not possible in all cases. The quantity is too large to be made and sold conveniently as curds, the Dairy is often too far away precluding the sending of the skim milk to the town without its going bad, and those who own these outfits do not always keep enough cattle but purchase most of the milk they handle.

The possibility of making use of the skim milk profitably by the preparation of casein deserves investigation. Casein can be put to use in a large variety of ways and many valuable articles are made in this way. In our "Selections" will be found an intersting set of recipes for the preparation of Casein and Casein products, being the result of work conducted in the Agricultural Research Institute, Coimbatore by Mr. M. R. Ramasami Sivan, Ag. Agricultural Chemist, Madras, and published in the January number of the Agricultural Journal of India. We have no doubt that the receipes will be found exeedingly useful.

* * *

Manure for Paddy.

Cases are repeatedly coming to our notice in the course of our district work of commendable enterprise on the part of our ryots. The one to which we draw attention below relates to the use of oil cake, bonemeal and of special manures for paddy. Near Chennapatna one of our clients has begun to use oil cake as manure for his extensive paddy lands. The method of using the cake is very similar to the way in which many sugarcane growing ryots use oil cake for sugarcane, that is to say the cake is softened by soaking in water, and the mash is

stirred up then with irrigation water and put on the field. At the head of a range of plots, the cake pit is dug which is about 2 ft. deep and 3 ft. square and at the rate of one pit for each range; the sides and bottom are well rammed with puddled clay; this makes the pit fairly water tight; the oil cake which is the stonehard lumpy veriety turned out of the country bullock *ganas* is put into this pit and soaked overnight in water; the mash is stirred with more water and then taken out in potfuls the next day and sprinkled uniformly over the puddled paddy plots prior to transplanting. This is a very convenient method of using oil cake especially when it is in the form of these hard lumps. This client was using the cake at the rate of 375lbs. to the acre. In the Mysore district round Nanjangud and Yedatore a mixture of bonemeal and oil cake was distributed as manure for paddy and about 10 tons were taken by ryots. In the Hoskote taluk of the Bangalore District the use of a special paddy fertiliser prepared and sold by Messrs. Parry and Co., has found favour. In the Malur and Goribidanur taluks of the Kolar District, bonemeal by itself has been used for some time and the bonemeal stocked by us for mixing with oil cake later on, in our depots in that district is being applied for and taken up for use as bonemeal by itself by some of the ryots in these taluks.

In this connection it is well to remember that it is very difficult to prescribe manurial mixtures that will suit all paddy soils in the sense that the net returns should be adequately remunerative, and our clients would do well to try such manures as they may wish to use on small portions of their holdings in the beginning and make the practise general only on the results of their experience in the first year.

* * *

The Food Situation in Mysore.

In the last number of the Journal we commented on the serious food situation in the State and the measures that may be adopted for relieving the situation as far as it may lie in the power of the agriculturists by way of raising quick growing food crops in all suitable localities. Reference was also made to the action that might be taken by the Government itself by way of

rendering financial and other help, organising seed depots and granting concessions for temporary cultivation. Since then several important orders conceived in a generous spirit have been passed by the Government and readers will no doubt be greatly interested in the several measures ordered.

These orders may be summarised as follows:—

1. G. O. No. 10487-546-P.P. 41-18-6 dated 4th December 1918, sanctions a sum of Rs. 50,000 to the Department of Agriculture for the purchase of seed grains and for an additional temporary establishment of 8 Agricultural Inspectors and 32 Fieldmen, and other staff. It directs the Chief Engineer and the Revenue Commissioner to make the necessary arrangements for the provision of irrigation water; the Deputy Commissioners of Districts to help in the purchase of seed grains and finally the Director of Civil Supplies to facilitate the prompt transport of seed grains from place to place.

2. G. O. No. 19498-512-P.P. 134-18-379 dated 5th March 1919, records the results of a census of stocks of food grains in the State taken on 10th December 1918, draws attention to the fact that the supply would be sufficient for only 7 or 8 months at the most and directs among other things the Revenue Commissioner and the Director of Agriculture to submit proposals for stimulating the cultivation of quick growing crops.

3. G. O. No. R. 12921-74-L.R. 42-18-15 dated 7th April 1919, directs the supply of irrigation water in the Cauvery Channel areas during the current hot weather and the levy of a water rate of Rs. 2 per acre for such water.

4. G. O. No. G. 24978—92—P. P. 41—18—26 dated 5th May 1919, orders the opening of seed depots for the supply of seed grains in all Taluk Head quarters and the sale of the seed grains at rates not exceeding the local market rates for grains used for consumption, directs prompt disposal of applications for Takavi loans for the purchase of seed grains on the very day of the receipt of such applications; the same order also provides for a reserve stock of seed grain, should the first sowings fail for want of rain and seed grain be required for resowings.

It will be seen that fairly elaborate measures have been ordered in order to meet the situation. Considerable progress has been made in the cultivation of quick growing crops both under tanks and the channel areas. The stocking of seed grains is going on apace and we are particularly glad that ryots are freely availing themselves of the departmental stocks of seed grains.

* * *

Hydrocyanic Acid Content of Green Jola Fodder.

It is well known that green jola fodder at certain stages in its growth is poisonous to cattle. The poisonous effect is due to the presence of Prussic Acid, (or Hydrocyanic Acid) which is generated by the decomposition of a glucoside in the plant. The conditions which influence the formation of this glucoside forms the subject of a study by Mr. M. Ghosh of the Sabour Agricultural College published in the Agricultural Journal of India January 1919.

The study has been made of plants grown in plots out in the open, a fact which in our opinion discounts considerably the value of the results. We wish that pot culture methods were used, for the subject is such that the experiment should admit of absolute control of the various conditions likely to influence the result, which can be obtained only in pot experiments.
Among the results are the following :—

1. The Hydrocyanic Acid is generally found in the leaves much more than in the stalks ; the proportion between these quantities varies very much in the experiments cited, taking the Hydrocyanic Acid content as 1 in the stalks, that in the leaves varies from 1 to 5.

2. The quantity of Hydrocyanic acid in the plant diminishes with its age, thus in the case of crop sown on 8—7—1917 the acid at various stages of its growth was as under :—

25—7—17	·045	per cent.
1—8—17	·038	,,
9—8—17	·028	,,
15—8—17	·0285	,,
21—8—17	·017	,,

29—8—17	·015 per cent.
5—9—17	·005 ,,

3. Contrary to common belief, well grown plants are said to contain more acid than those stunted in growth.

4. An excess of water in the soil is also said to inhibit the formation of the acid.

The subject is worthy of more accurate study and we commend it to the Chemical section of our department.

* * *

Hongey Plantations for Green Manure.

It is a peculiar feature of some villages in the Eastern part of the state that ryots plant and maintain large plantations of Hongey trees for the purpose of obtaining the green leaf manure which they prize very much for use on paddy fields. The following note sent to us by Mr. H. G. Hanumiah Chetty, Head Master, Chikanhalli Vernacular Agricultural School, on the subject will be found interesting.

Paddy is grown extensively in the tract round about this School, being all irrigated by the large tank of Kallambella. Excellent and extensive arecanut gardens also abound. All the cattle and sheep manure available to the ryot are used for the gardens, and for the manuring of the paddy lands, they depend upon hongey leaf manure. For this purpose many ryots maintain hongey plantations on their holdings. These plantations range from three to ten acres in extent. From 80 to 100 trees are raised on each acre. The lopping of the trees begins after the 7th year, and from each tree from two to eight headloads of leaves and twigs can be expected. Usually the trees are lopped every other year, but this is not strictly observed. The lopping is done in the months of Karthika and Margasira, *i.e.*, November and December so that the leaves can be used for the Vaisak sowing. In addition to special plantations, hongey trees are planted on the margin of the fields, and along the hedges. Trees on Government waste land are also lopped and ryots go long distances to obtain leaves from the jungle. It is not every ryot however who owns such plantations; it is also seldom that a ryot can get all the leaves he wants from

his own plantation. In such cases ryots travel as far as 15 miles to purchase enough green leaves. This is bought at from Rs. 5 to Rs. 15 per 100 headloads (equal to 5 cartloads), the cutting and carting charges being borne by the purchaser.

An ordinary plantation if sold for the leaves will fetch Rs. 50 per acre, once every two years. Each acre of paddy land is manured with from 100 to 300 head loads of green leaves costing, if it is all purchased from Rs. 12 to Rs. 36.

* * *

The Use of Oilcake as Manure in Madras.

The following extract from an article by Mr. H. C. Sampson, Deputy Director of Agriculture in Madras, in the Madras Agricultural Calendar for 1919-20 should be found interesting to Mysore farmers.

"In South Arcot oilcakes are largely used for manuring paddy and sugarcane. The dry red soils of this district produce the ground nut crop and the whole crop of these oilseeds is sold. In order to maintain the outturn of this crop all available supplies of cattle manure are supplied to these soils This means that the wet lands have to do without. In order to maintain the fertility of the wet lands, groundnut poonac (oilcake) is applied to the paddy crop at the rate of 500 lbs. for one cawny ($1\frac{1}{3}$ acre).

* * * * *

In the Godavari and South Arcot Districts the sugarcane crop is always manured with castor poonac which is applied at the rate of four to five candies (1 candy = 500 lbs.) per acre.

* * * * *

In the Cauvery Valley near Erode, farmers have within the last few years realised the value of groundnut cake as a manure and it is now extensively used for manuring such crops as plaintains, sugarcane, turmeric and paddy."

In Mysore a similar story can be told of the sugarcane crop in the districts of Bangalore and Kolar. But elsewhere though the need is great, the practise is not common and it is only through the efforts of the department that its use is being taken up. The steady rise in the price of oilcakes within the last three

years, hampers this campaign very considerably ; yet we have reason to believe what the Mysore ryot considers a very high price is not regarded as such outside of the state, for the cake manufactured within our state is finding a ready sale outside not alone as manure on Coffee and other plantations, but for sugarcane and similar crops as well. Mr. Sampson says in the course of his article " These few examples show that many farmers in Madras have come to realise the value of oil cakes as manure and now that the price of oil cakes is so low, it is hoped that many other Farmers will try for themselves and prove if these facts are as stated.". In these days of easy transport there cannot be much difference in the price of the cake between here and in the tracts mentioned by Mr. Sampson. Yet it is there characterised as low. This ought to open the eyes of our farmers, for bad as the situation is, it is not worse than that in which our brethren across the border are placed and it behoves us to see that the cake produced in the state is all used by our farmers themselves and not allowed to go outside.

SELECTIONS.

The movement of plant food within the soil.

In connection with work on this subject Van Alstine started a series of experiments to determine the total amonnt of various plant food elements in the surface and the lower strata of the soil and trace the ultimate fate of the plant-foods added in the form of fertilizers. As a result of his work he comes to the following interesting conclusions (a) Phosphorus remains where it is applied in the soil, until removed by the crops or by erosion. (b) The additon of alkali salts such as potassium sulphate seems to encourage the utilization of phosphorus (c) In fully cropped land the nitrogen is more or less retained and when applied in the form of Ammonia it is retained in the surface soil, in the debris and roots of plants. (d) Potassium has a tendency to get leached out very soon by passing into the lower substrata (e) carbonates are washed out from the soil especially when ammonium salts are added which are also responsible for loss of magnesium and calcium from the soil.—*Soil Science Vol. VI, No. 4.*

Influence of Plant Residues on Nitrogen fixation.

During the course of investigation on this subject, Hutchinson has come to the following conclusions. The estimated loss of nitrogen by disappearance of nitrates in the soil is not a real loss because there are several organisms known to have the capacity of assimilating nitrogen in the form of a nitrate and elaboraing it into Protein. Even under conditions most favourable for true denitrification upwards of 25—30% of the total nitric nitrogen can frequently be recovered as Bacterial protein. Nitrate disappearance does not therefore provide a true index of actual soil losses. Where the soil conditions are such that an excessive leaching of soluble nitrates is likely to take place, the retention of nitrates in the form of Bacterial protein is an obvious advantage. The nitrogen content of the soil may be appreciably increased by the activity of Azotobacter when suitable carbohydrates including plant residues are added to the soil. In actual experiments 6-9 mgms of nitrogen per gram of plant residue supplied has been obtained. Under favourable conditions 20-54% of increased crop has been obtained from the application of carbona-

ceous compounds (sugar) and as the plant residues resemble sugar they may also serve indirectly to enrich the soil nitrogen reserves The other necessary conditions for nitrogen fixation are a suitable temperature, presence of phosphates and a suitable basic material as calcium carbonate.—*J. Ag. Sc. Vol. IX, P. 92, 1918.*

Casein and Casein Products.

Casein. Skim milk (cows' or buffaloes') from a cream separator was used for the preparation of casein. While the coagulation of milk can be effected by several methods, e. g., by the addition of sulphuric acid, rennet or sour milk, precipitation by sulphuric acid was found most convenient and was effected by mixing 1½ parts by volume of strong sulphuric acid with 7 parts of water and adding the mixture to 1,000 volumes of milk. The precipitated casein was washed and dried and formed the base for the manufacture of a number of products.

Casein paints and distempers. Casein dissolves in solutions of the hydroxides of alkali and alkaline earth metals, being less soluble in the latter. The casein-lime compound, however, has the power of absorbing carbonic acid from the air and becoming insoluble and it is this property which is utilized in the making of casein paints and distempers. These consist of mixtures of casein and slaked lime with suitable pigments. On the addition of water, the casein and lime combine to form a sticky soluble product holding the pigment in suspension. When spread as a thin layer with a brush on any surface—wall, timber or iron—it absorbs carbonic acid from the air becoming an insoluble durable coating which holds within itself the particles of the pigment. When applied to walls, the paint enters into combination with the uuderlying plaster and becomes increasingly durable.

The proportions of lime to casein and of the lime-casein to the pigment in the mixture are important. Too little lime makes the product insoluble, especially if exposed during storage, and too much lime induces the paint to come off in flakes. Similarly if too little paint be added, the coating is brittle and liable to flake off, and if too much, the paint will dust off and not stand washing. Again, it is only those pigments which are not affected by lime that are suitable for the manufacture of casein paints These are for example:—

Whiting, zinc oxide and China clay	...	for white
Ochre, chrome yellow, etc.	...	„ yellow

Raw and burnt sienna and umber	...	for brown
Soot and carbon blacks ...	...	„ black
Red lead	...	„ red
Ultramarine	...	„ blue
Green earth, lime green, etc. and so on.	...	„ green

The recipes for the different paints are slightly different. White paint may be made up of casein 100, slaked lime 100 levigated chalk 800, borax 1 and ultramarine 2 to 3 parts by weight, while the coloured paints may be made from casein 100, slaked lime 100, levigated chalk 400, pigment 400, and borax 1 part. It is important that the ingredients are vere finely powdered and thoroughly dried; when stored in tightly closed boxes lined with paper, the mixtures keep indefinitely without losing their properties.

For use, 50 parts of water are added to 100 parts of the powder in a clean vessel and stirred untill the mass is homogeneous and free from lumps. The contents are then covered with a thin layer of water and set aside for 45 minutes, after which they are stirred with more water to the consistency of an oil paint. Thus prepared, it should be used without delay as it is liable to set hard in a comparatively short time becoming unfit in twelve hours. Rough surfaces must be painted thinner than smooth ones. As mentioned above the paint will adhere to any clean surface, such as lime, plaster of paris, cement, plaster, brick, timber, stone or metal, as well as canvas. It dries quickly with a matte surface and, after 36 to 48 hours, can be washed without fear and will stand the weather. So long as old coatings of lime on walls are removed and the sub-stratum is firm, the casein paints will readily adhere and will not crack or peel off. A glossy paint for indoor use can be produced by spraying the painted surface with a mixture of turpentine and wax, polishing it afterwards.

Casein adhesives.—Casein, in solution with caustic alkalis or alkaline salts, has adhesive properties and, as such, has been applied for the preparation of glues and cements which have been placed in the market under various trade names, such as caseinglue, cold glue, caseo-gum, etc. These are suitable for several industrial purposes, especially in wood work, as they are ready for immediate use without previous soaking and heating as with ordinary glue.

For wood, China and glass, 15 to 20 parts of casein are mixed intimately with 1 to 4 parts of borax and sufficient water added with careful stirring, when required for use.

Casein dissolved in a strong solution of borax forms a good clear adhesive, keeps indefinitely and can replace gum arabic or dextrine. Caustic soda or potash or ammonia could be used instead of borax in making this liquid glue and the addition of a little carbolic acid or thymol prevents any chance of putrefaction.

Casein film.—Casein was tried as a substitute for gelatine in the preparation of photographic paper with good results. Writing paper of good quality was coated with a solution prepared as follows:—

Seventy grams of casein were heated with one litre of water to 50° C., 100 c.c. of a 25 per cent. solution of citric acid added and the mixture stirred until a homogeneous solution was obtained. Twenty grams of glycerine were then added.

The paper which was coated with the above was, after drying in the shade, drawn through a 5 per cent. solution of ammonium chloride to render the casein insoluble, dried and sensitized in the dark room by floating in a 10 per cent. solution of silver nitrate, and again dried in the dark room. Prints were obtained as on ordinary P. O. P., and the operations of toning and fixing were the same as with P. O. P.

Shoe and boot polishes.—After several trials, the following recipes were found successful:—

Brown polish.—Dissolve 1 part of borax in 20 parts of water, add 5 parts of shellac and warm until dissolved. Add 1½ parts of soap and 2 parts of casein and stir over the water bath until a homogeneous paste is obtained. Now add 2 parts of hard paraffin and incorporate with the paste, and then add gradually, with constant stirring, 30 to 40 parts of turpentine, thinning down with more water as may be found necessary. Finally add enough annato extract to give the required shade of colour.

Black polish.—Dissolve 2 parts of casein 40 parts of vinegar add 2 parts of paraffin and heat on the water bath, stirring the while until a pasty mass is obtained. Next add 50 parts of turpentine gradually and stir on the water bath to a uniform paste, adding water as may be necessary, and then incorporate sufficient lamp black into it. A few drops of nitrobenzene are also added at the end to give an agreeable smell.—*Agricultural Journal of India, Vol. XIV, Part I, pp. 78 to 82.*

Bacillus solanacearum Injurious to Ricinus, in the U. S. A.

To the already considerable list of natural host plants of *Bacterium Solanacearum* (brown-rot of Solonaceæ) must now be added the castor oil plant (*Ricinus communis*), which has been seriously attacked by the fungus in various localities of Georgia and Florida.

The *Ricinus* plants wilt in various stages of growth, and often at an early one. Dwarfing is usually the first sign of the disease in the seedling plants.

By using a culture of the bacterium isolated from the castor oil plant the author was able to produce the disease in several plants known to be subject to *B. Solanacearum*.

Land on which any of the common Solanaceous plants have wilted should not be planted to *Ricinus*, unless it is known positively that the wilt was not of bacterial origin.—*Smith, E. F. and Godfrey, G. H., in Science, New series, Vol. XLVIII, No. 1228, pp. 42-43. Lancaster, July 12, 1918.*

How to Avoid Intermittent Bearing of Fruit Trees.

In a recent article in *Country Life*, it is maintained that the intermittent bearing of fruit trees can be avoided by a proper system of manuring. The writer, H. Vendelmans, says that, in spite of a very common belief, it is certain that the bearing capacity of fruit trees is not limited to every other year. Ninety-one orchardists out of every hundred in England assert that a good crop is followed by a thin crop, and vice versa; but the regularity with which excellent returns are obtained annually from espalier trees, and trees under glass, which receive different treatment from that meted out to orchard trees ought to suggest some scepticism about the old tradition. In the case mentioned, it is possible to rely on good crops every year. Among the reasons which explain this more regular bearing manure takes a first place. Without it, the abundant crop of one year makes so great a demand upon plant food that the reserves of the trees are exhausted, and are not strong enough to feed a new crop for the next year. Hence a poor return follows a good return. In the year following the bumper crop, the trees often carry no fruit at all, but they accumulate new reserves, and are then ready to feed a large crop the next year. When the exhaustion of

the trees is prevented by appropriate manuring, fruiting takes place much more regularly.

In manuring fruit trees, it is necessary to bear in mind that the blossom buds are formed the year before they come out, that is to say, during the period of bearing, or shortly afterwards. Consequently, they are forming at a time when the trees are being exhausted or have been exhausted. Therefore, a liberal supply of easily assimilable manure must be placed at their disposal during this period. Liquid manure, woodashes, basic slag, and lime should be used, taking into account that a superabundant supply of nitrogen might lead to a production of wood instead of flower buds, and that phoshates assist in developing the flavour of the fruit.

This serves to emphasize the essential use of manures in orchard cultivation, if the best results are to be attained.—*The Agricultural News. Vol. XVII No. 429 October 5th 1918.*

The Root System of the Cocoanut Tree.

The cocoanut being a monoco tyledon has no tap root and the roots given off from the bole are all of much the same diameter New roots are constantly being formed to cope with the increased growth of the tree and to take the place old roots which have died. These roots change colour as they become older, but how far this colour can be taken as an indication of exact age has yet to be investigated. The young growing root is a white creamy colour which turns first to a light orange and in time becomes deeper coloured to a madder brown and finally becomes almost black.

In individual roots the colour change can be traced from the root cap backwards to the bole, though such roots are too young to show the darkest shades of colour.

In these deep red sandy loams, such as is represented by the acquired garden, the local practice is to plant seedlings at the bottom of pits some 3—4 feet deep and even deeper. These pits are filled up when the tree has become established. From the examination of such trees it appears that the boles develop above the depth at which the original seedling was planted. This may not be generally applicable. Where, for instance, seedlings are planted on raised ground such as in back-water areas, it is probable that the bole has to develop downwards in order to secure a firm root hold. In any case it is of interest to note that, in the case of two trees examined no roots at all were given off from within 1 foot of the surface in one

case and within $1\frac{1}{2}$ feet from the surface in the other case. That is to say that the stem of tree was buried to this depth in both cases. Yet, in trees planted near the surface on moist backwater soils, roots are usually seen being given off above the ground level. From this it can be concluded that there is a definite surface of the base of the bole which is normally capable of producing roots. This portion on the two trees examined was 2 feet 3 inches and 2 feet 6 inches in depth in the two cases, *i. e.*, from where roots commenced to be produced below the ground to the pointed apex of the bole. The roots, given off from the bole, whenever they come near the surface of the soil form numerous branching rootlets, which form a thick matted mass within the surface one foot of soil. These rootlets branch very freely and countless tiny branch rootlets are formed, through the surface of which soil water is taken in. These rootlets are devoid of root hairs and absorption is done directly through the tender surface of these rootlets. Below one foot depth it is seldom that such branch rootlets are seen though such deeper roots do occasionally branch when rootlets happened to get injured ; they can also form a new growing point behind the injury and occasionally two such growing points are seen on the same root which in this case gives two branch roots. The general opinion of cultivators on the West Coast is that the branch rootlets found near the surface of the soil are of no use to the plant and on this presumption good cultivators each year, before the commencement of the rains open out the soil around the base of the tree to a radius of some 4 feet and they often remove this soil altogether to a depth of 6—9 inches, only returning this soil at the cessation of the South-West monsoon. What apparently they really do is to vigorously root prune and thereby encourage the growth of fresh rootlets. These are allowed to develop properly and as the rainy season commences to recede, the soil is returned. The roots therefore are protected against the heat of the sun and the dryness of the surface soil by a thick soil mulch. The object of cultivators therefore in a cocoanut garden is apparently to protect these feeding rootlets by keeping them away from the soil surface in dry weather and allowing them to develop deeper in the soil by improving the soil aeration and drainage.

Investigation has not yet gone far enough to show how far the main roots can travel through the soil. It is evident, however, from observations made so far that these travel very considerable distances The major portion of the roots given off from the bole have a tendency to grow downwards and many of them go down very steeply. There

is ample evidence to show, however, that some of these, at any rate if not all, ultimately come up again to the surface where they commence to form branch rootlets at long distances from the tree to which they belong. Apparently therefore the function of the main roots is to conduct the plant food solution from the branch rootlets to the tree. The tender extremities may also take in water, as otherwise it is difficult to explain how, during the long period of drought which extends from November to May and during which time the main harvest of nuts are maturing the trees can maintain their vigour.—*Report of the work of the cocoanut stations in the Kesargod Taluk, 1917-18, by Mr. H. C. Sampson, Deputy Director of Agriculture.*

Green Manure Crops in orange orchards.

The following summary of the results of experiments at the College of Agriculture Experiment Station, Berkeley, California, recorded in *Bulletin* No. 292 of the University of California publications will probably be of interest to growers of citrus crops in these West Indian islands.

Green manure crops have had a marked effect on citrus trees. The trees on the plot where legume green manures have been annually turned under are superior in every way to those similarly fertilized, where no leguminous green manure has been used. Green manuring has resulted in a 30 per cent increase in size of tree. The total yields at the age of ten years were 68 per cent greater on the green-manured plot. Not only was more produced but the fruit proportion of fancy and choice fruit was larger. Green manuring had a marked effect upon the size of the fruit, there being 63 per cent more of the desirable sizes than on the plots not green manured. The trees where legume green manure had been used were in much better health, as evidenced by the fact that only 3 per cent of the leaves were 'mottled' during the seasons of 1912, 1913 and 1914, while on plots similarly fertilized, where legumes had not been used, the average was 13.5 per cent.

Green manures have additional values in that their growth prevents serious washing of the soil during heavy rains.

Large amounts of nitrogen are saved from leaching below the limits of roots by growing winter-green manure crops which utilize the excess nitrogen, and hold it until they are ploughed under. The

decay of the roots of the crop tends to make the soil more open to the access of air and water.

Green-manure crops may be expected to give most satisfactory results when ploughed under to a depth of from 7 to 10 inches. They should never be ploughed under when the land is dry, as this will result in poor incorporation of the green tops, and slow decay.—*The Agricultural News, Vol. XVII, No. 431, November 2nd 1918, pp. 344.*

Experiments on the Electro-culture of growing crops, in Scotland.

The experiments described were begun over 9 years ago by Mr. Low, of Balmallewan, on his farm of Mains of Luther, Kincardineshire. He tested on a field scale the effect of a high tension overhead electric discharge distributed on the system of the Agricultural Electrical Discharge Co., Ltd., upon ordinary farm crops. After experiments had been carried out on a large scale for some years upon a number of fields under the ordinary rotation of the farm without any distinct result being obtained, Mr. Low, in order to avoid some of the difficulties and sources of uncertainty encountered in the experimental method previously followed, drew up, in consultation with the author, a plan for a series of plots upon a selected piece of ground of an area of about 6 acres, situated in one of the fields of the farm.

The Lodge Newman apparatus, supplied by the Agricultural Electric Discharge Company, Limited, was used for producing and distributing the current. By this apparatus an ordinary 200 volt current is transformed by an induction coil into a high tension current of from 60,000 to 100,000 volts. By means of valves patented by Sir Oliver Lodge a charge is accumulated on the overhead network. These valves allow electricty to pass only in one direction, and so only a current of the desired sign can flow to the overhead network, and it is retained there save for leakage and for discharge from the fine radiating wires through the air. The effect is to make the field with the growing crop and the net-work a leaky condenser, the field and crop being charged with negative electricity while the overhead network has a positive charge. As the apparatus has already been described on many occasions it need not be mentioned further.

The apparatus was installed by the Officials of the Agricultural Electric Discharge Company Limited, and was on various occasions

visited and inspected by their representatives. Improvements were installed at considerable expense by Mr. Low to avoid leakages etc. In fact, he had adopted all the suggestions made by the Societies' experts who expressed themselves as quite satisfied with the apparatus and the way it was worked.

Conclusions.—In the experiment at Mains of Luther, the application of a high tension electric discharge on the Lodge New man system to growing crops has been throughly tested over a period of 5 years and no consistent improvement in any of the crops grown—oats, barley, hay, potatoes, turnips, and swedes was obtained. There seems no reason to suppose that electric current applied in this way to growing crops will give results that repay the cost and trouble incurred. Much more scientific work requires to be done to determine the effect of electric discharges on growing plants before we can apply such treatment economically to farm and garden crops or even to decide what kind of apparatus should be used. Great care is needed in reporting the results of electrocultural experiments so as not to create premature hopes of immediate practical results which when they are not confirmed, cause disappointment and lead practical men to conclude that science merely leads to useless and wasteful expenditure.—*Taken from the International Review of the Science and Practice of Agriculture Vol. IX No. 10.*

Notes on the Cultivation of Bananas.

The following notes are not intended to be a guide to banana cultivation but consist of hints on improvement in the soil, when necessary, for higher yields.

It has been shown by several investigators that the banana takes up large quantities of potash from the soil *(vide Agricultural Bulletin*, Vol. V, No. 4 January 1917.)

Experiments carried out by Brunnich in Queensland (*vide Transactions of the Third International Congress of Tropical Agriculture*, Vol. II, 1917) have also shown that the banana responds very readily to manuring with potash fertilizers especially on exhausted land and that large quantities of potash can be applied with advantage and with commercial success, the increases in yields of fruit compensating handsomely for the expenditure on the fertilizer and its cost of application.

The banana also flourishes best on soils containing a fairly high percentage of organic matter and soil which is moist.

All organic refuse, therefore, and ashes from burning wood, etc., which contain potash, should be applied as fertilizers when available and all banana refuse, skins of the fruit, etc., should be again dug into the soil for a similar purpose.

The banana plant requires a well-drained heavy soil, containing a fair amount of humus and good amounts of potash, lime and phosphoric acid in an available condition, in order to get the best results.

Irrigation, heavy manuring with organic fertilizers, dung, etc., have given excellent results and potash manuring has also been applied successfully in India. Liming experiments in different countries have also proved the value of this fertilizer and potash is pre-eminently required.

Green manuring is also practised with success, but the green manures grown should be kept away from the stools, in order to avoid robbing the banana plants of moisture.

No other cultivated plant, according to one authority, exhausts the soil to such an extent as bananas and this is borne out by soil analyses, especially in respect of potash content.

A fair crop of bananas removes 123 lbs. of potash, 12·5 lbs. of phosphoric acid and 43·7 lbs. of nitrogen per acre from the soil and the stalks left on the ground contain 150 lbs. of potash, 6 lbs. of phosphoric acid and 41·4 lbs. of nitrogen.

With regard to potash, this means that 273 lbs. of potash or say 5 cwts. of sulphate of potash per acre must be readily available in the soil to produce a good growth and crop.

The standard fertilizer used in Queensland contains 160 lbs. of potash, 80 lbs. of phosphoric acid and 40 lbs. of nitrogen, applied per acre twice a year to normal crops and in double quantities to crops on exhausted land.

The first lot of manure may be applied to the holes when planting (holing 12 feet apart) and the subsequent applications as top dressings and hoed under.

It is recommended in old plantations to apply half the fertilizer round the stools in holes, made by a crowbar to a depth of 18-24 ins. round the plant and three to five feet from the plant and the remainder as a top-dressing.

A striking feature on poor land is the formation of "blind bunches". In the Queensland experiments, which have proved very successful, nearly two tons of fertilizers have been applied annualy, the cost amounting to £ 26 per acre and when lime was also applied, to as much as £ 29 per acre. The average yield on the plots with this application was 457 bunches containing 4,330 dozen fruits of a value of £254 per acre, which shows big increases over plots to which half the amount of fertilizer was applied and still more over non-manured plots.

Potash may be applied as sulphate or in other forms, phosphoric acid as basic slag or superphosphate and nitrogen as dried blood or nitrate of lime. Incomplete fertilizers, without potash, barely pay for the cost of the fertilizer.

The following figures illustrate the value of fertilzers:

Application of manure	Nil			P. N.			K. P. N.			2 (K.P.N.)		
	£.	S.	D.	£.	S.	D.	£.	S.	D.	£.	S.	D.
Cost of manure per acre.	Nil			9	8	6	12	6	6	23	4	0
Value of banana crop per acre.	28	11	9	39	3	0	67	2	3	55	15	2

(*Note.*—K. = Potash. N. = Nitrogen. P. = Phosphoric acid.)

These heavy manurial applications do not affect the physical character of the soil, owing to the utilization of the fertilizer by the plant.

The Government of Madras and the Madras City Dairy business.

G. O. No. 410, 7th March 1919.

Agricultural Department.

READ—the following paper :—

Letter—from G. A. D. Stuart, Esq., I.C.S., Director of Agriculture, Madras.

To—the Secretary to Government, Revenue (Special) Department.

Dated—the 23rd January 1919.

No.—R. O. C. 5323-Gl. of 1918.

I have the honour to submit proposals for the improvement of the dairy business of Madras town.

2. A reference is solicited to Bulletin No. 73 of the department—'A Survey of the Madras Dairy Trade' by Mr. A. Carruth, the Deputy Director of Agriculture for Livestock—for a description of the existing state of affairs, and to the paper on the 'Dairy Trade and its Improvement' by the same officer, which will be found on pages 198 to 207 of the Journal of the Madras Agricultural Students' Union for August 1918 for proposals as to how this state of things can be remedied.

3. It is useless to expect any improvement until the industry can be put on an economic basis. And the only way to do this is to find a cow that will produce enough milk to pay for its keep and for some profit to the dairyman. There are no signs of any really good milking strains even in the Ongole breed, which is our best local one. Therefore the solution of the problem must be sought in cross-breeding.

4. I do not think that there is any escape from this conclusion. One is confirmed in it by the fact that the Madras milkmen have already sought to solve the problem on these lines. A large number of the milch cattle in Madras are already cross-bred—but this introduction of foreign blood has taken place in a haphazard manner, and there his been no attempt to breed out a good milking strain—vide Part VII, page 32 of 'A Survey of the Madras Dairy Trade.' Again the Military have gone in largely for cross-breeding at all Military dairy farms.

5. Mr. Carruth selects the Ayrshire breed as the most suitable for crossing with Madras cows and I think that his conclusion must be accepted. The Military Farms department have imported large numbers of bulls of this breed—I know that at least 30 have been imported in each of the last two years, possibly more.

6. Owing to the heavy losses of cross-bred cattle which we experienced at Coimbatore last year, I have hesitated to recommend any scheme which involved cross-breeding. However, as explained in my latter No. R. O. C. 2776-5655-Gl., dated 11th December 1918, I am satisfied that in the method of simultaneous inoculation, as worked out in recent years on the Military dairy farms, we have a sure means of combating rinderpest. We must always expect a certain percentage of loss, but this risk must be accepted because cross-breeding is the only way in which we can hope to bring about any permanent improvement in the milking capacity af Indian cattle.

7. I therefore submit the following definite scheme which has been worked out by Mr. Carruth :—

(*a*) Ayrshire bulls of a good milking strain to be purchased by Government.

(*b*) These bulls to be kept at suitable centres in Madras town for the service of the milch cattle of professional milkmen.

(*c*) An upper subordinate of this department to be stationed in Madras to look after the bulls and to get into touch with the milkmen.

(*d*) In return for the charging of a specially low service fee, the Government to have the option of purchasing the calves at a fixed price.

(*e*) These calves to be used to stock a Government dairy farm not too far from Madras where cross-breeding would be carried on with a view to the production of a stable dairy breed.

(*f*) Attempts to be made to start a co-operative society among the Madras milkmen, both for credit purposes, and to encourage them to go in for systematic breeding, co-operative purchase of cattle food, and possibly co-operative sale of milk.

8. The first step to be taken is the purchase of the bulls. Eight bulls will be required altogether if the scheme succeeds. For the present I recommend that four bulls should be purchased this

year. They should arrive at Madras in November next. Mr. Carruth estimates that the bulls will cost £130 each. They should be sent first to the cattle-testing station of the Board of Agriculture and Fisheries, Pirbright, Surrey (vide leaflet No. 290 of the Board) for being inoculated against piroplasmosis and tested for tuberculosis. On arrival in this country they should be inoculated against rinderpest by the simultaneous method. Allowing for all charges the four bulls will cost Rs. 12,000 landed at Madras.

The total cost of this part of the scheme may be estimated as follows :—

A. Capital Cost.	Rs.
(1) Cost of four bulls landed at Madras ...	12,000
(2) Cost of four bull sheds	4,000
	16,000
B. Recurring.	
Feeding charges, 150 × 4	600
Attendants, 15 × 12 × 4	720
Contingencies	200
	1,520

These charges would be doubled when eight bulls are kept.

9. It is not easy to estimate the cost of establishing a dairy and breeding farm. The cost of bulidings on the Chintaladevi cattle farm is proving much higher than was originally anticipated. Judging by these, the initial cost of such a farm would not be less than two lakhs, while the annual recurring cost would be about Rs. 20,000, but this should of course be largely recouped by sale of milk and stock.

10. If this scheme is generally approved of, I request sanction for the purchase of four Ayrshire bulls this year. A lump provision of Rs. 14,000 has been made in the budget for 1919-20 under 26-A (*a*) Agriculture III (3) Experimental Farms and Cultivation.

Order—No. 410, *Revenue (Special), dated 7th March 1919.*

MISCELLANEOUS.

The Government generally approve the proposals of the Director of Agriculture for the improvement of the dairy business in the Madras City and sanction the purchase during 1919 of four Ayrshire bulls. The Director is requested to consider and report on the question

of the locality for the proposed dairy farm and to submit in due course plans and estimates for the buildings required in that connexion.

2. The attention of the Registrar of Co-operative Societies is invited to paragraph 7 (*f*) of the Director's letter and he is requested to consider and report, in consultation with the Agricultural Department, on the feasibility of starting co-operative dairy societies and societies for credit purposes among the milkmen in the City as well as in other parts of the Presidency.

(True extract)

A. Y. G. CAMPBELL,
Acting Secretary to Government.

Government encouragement for the Cultivation of Sisal Hemp in Mysore.

Order No. 5369-77—*I. & C.* 169-18-3, *dated* 14*th December*, 1918.

Government are pleased to direct that the following concessions be granted for encouraging the cultivation of Sisal Hemp in the State :—

Free grant of land (unassessed kharab land by preference) to be made available either to individuals or village communities applying for the same up to an extent of 200 acres in each case under the following conditions :—

(*a*) The land to be free of assessment for five years and then assessed at progressive rates leading to full assessment from the eleventh year.

(*b*) The land to be planted up in full in five years.

(*c*) The land to be liable to be resumed if it is used for any other purpose within twenty years of the grant.

(*d*) Wherever there are not less than 1,000 acres under Sisal Hemp, Government will be prepared to help the cultivators to purchase the necessary machinery for extracting the fibre by advancing half the cost as a loan at a low rate of interest or arrange for the extraction of the fibre purchasing the leaves produced at a rate fixed so as to allow a fair margin of profit to the cultivators.

The above concessions will be in force for the present until about 5,000 acres are brought under cultivation, preference being given to subjects of the State in the grant of the land.

2. A sum of Rs. 5,000 may be spent on nurseries to be started by the Forest Department as proposed by Mr. A. Chatterton as soon as the concessions are notified and a sufficient number of applications for land is received; the cost being met by re-appropriation in the current year's budget of the Forest Department.

3. The Revenue Commissioner and the Conservator of Forests are requested to take all further action in the matter in consultation with Mr. Chatterton and submit reports of progress made from time to time.

P. G. D'SOUZA,
Secy. to Govt., Depts. of Edn. and Agri.